SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

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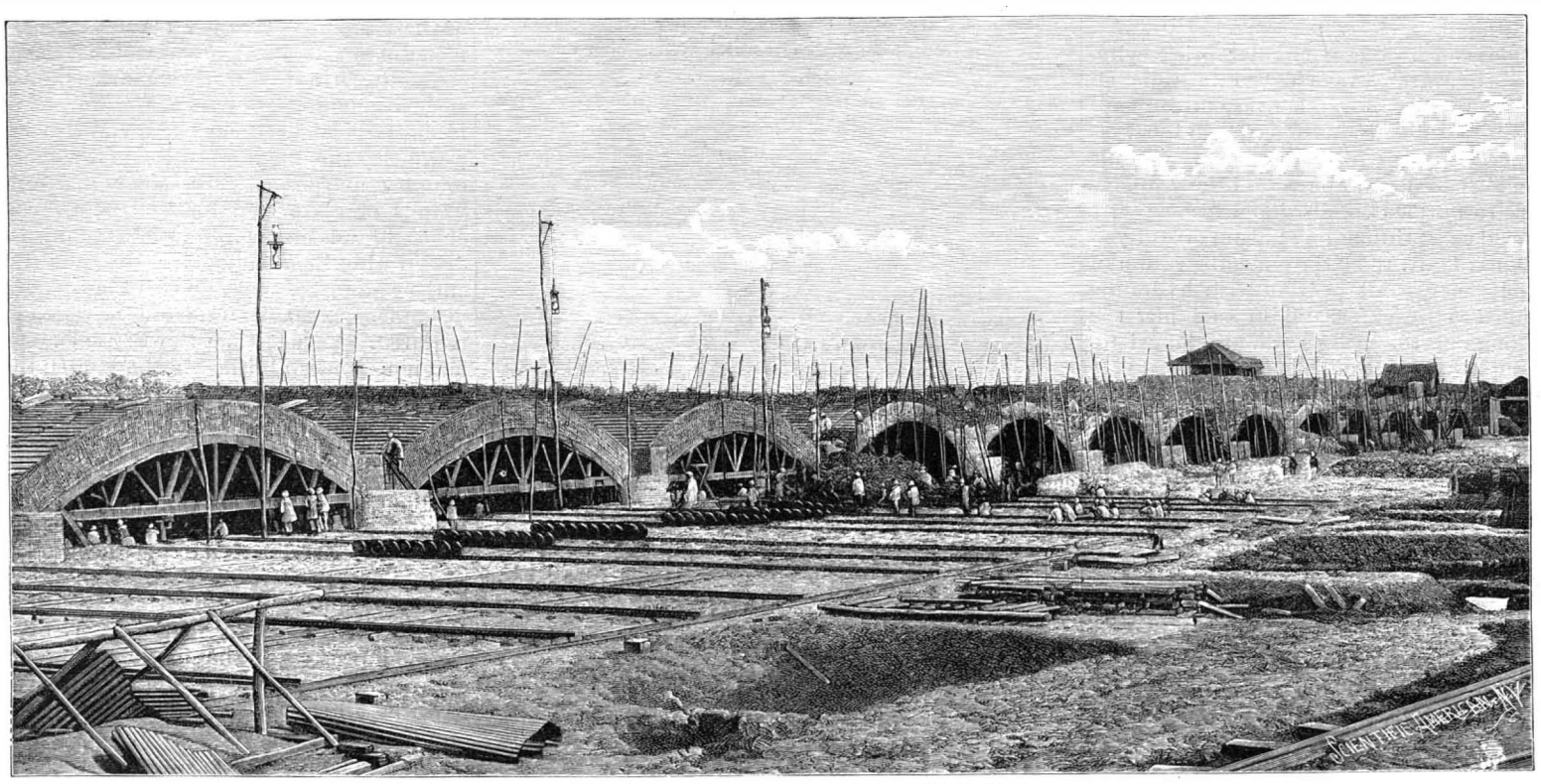
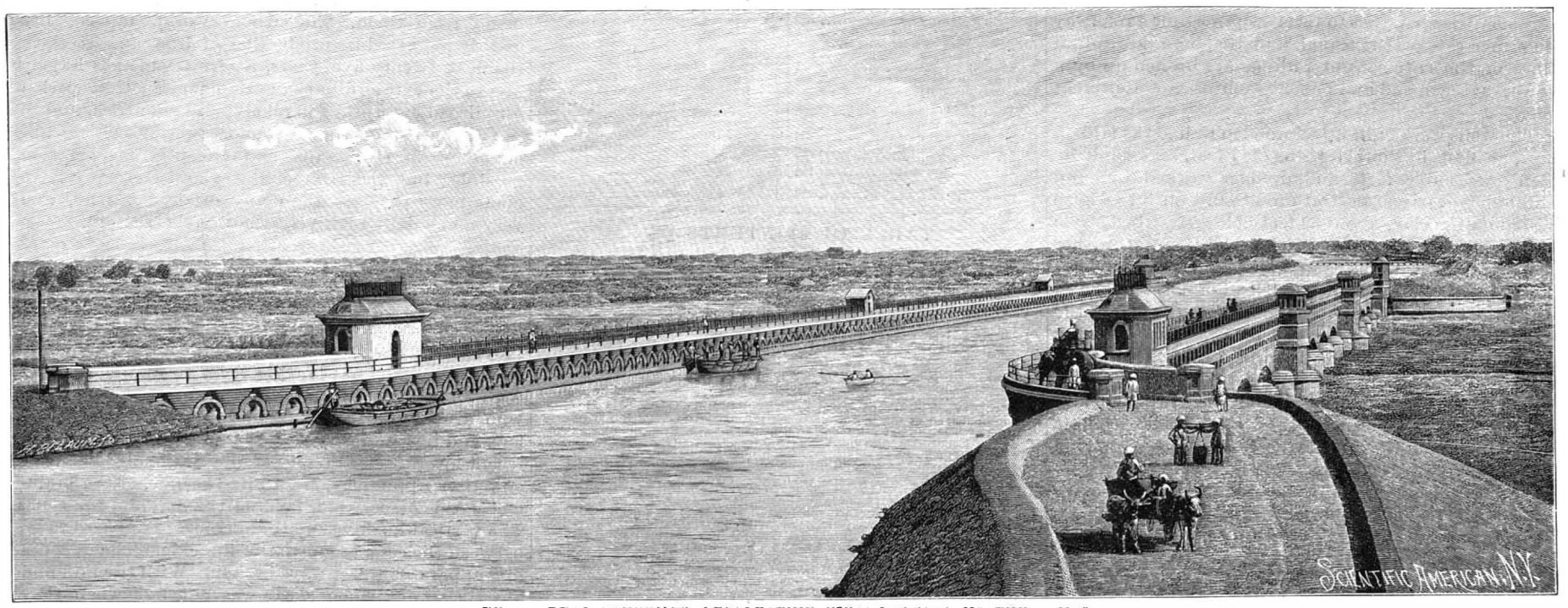
THE NADRAI AQUEDUCT, INDIA.

This great work in connection with the irrigation canals of the northwest Povinces of India was opened by Sir Auckland Colvin, the present lieutenant-governor of the northwestern Provinces of India, at the end of the year 1889, and, as it is one of the largest works of its kind in the world, a short account of it, for which we are indebted to *Engineering*, may prove interesting to our readers.

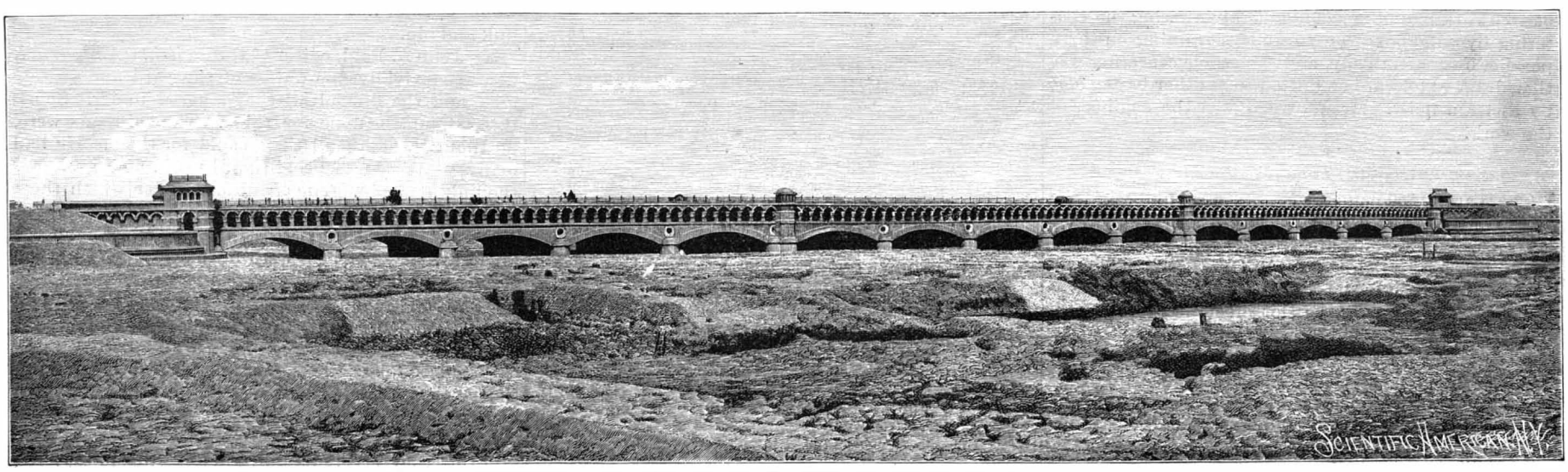
The Lower Ganges Canal, whose water this aqueduct carries over the Kali Naddi, was designed as an extension of the irrigation scheme of the Upper Ganges Canal, conceived and constructed by Sir Proby Cantley about the time of the mutiny, and was opened in the year 1876. In the year 1888–89 the Lower Ganges



THE NADRAI AQUEDUCT—BRICKWORK IN PROGRESS.



THE NADRAI AQUEDUCT—PERSPECTIVE VIEW LOOKING UP THE CANAL.



THE NADRAI AQUEDUCT—PANORAMIC VIEW OF THE DOWNSTREAM SIDE.

THE NADRAI AQUEDUCT, INDIA.

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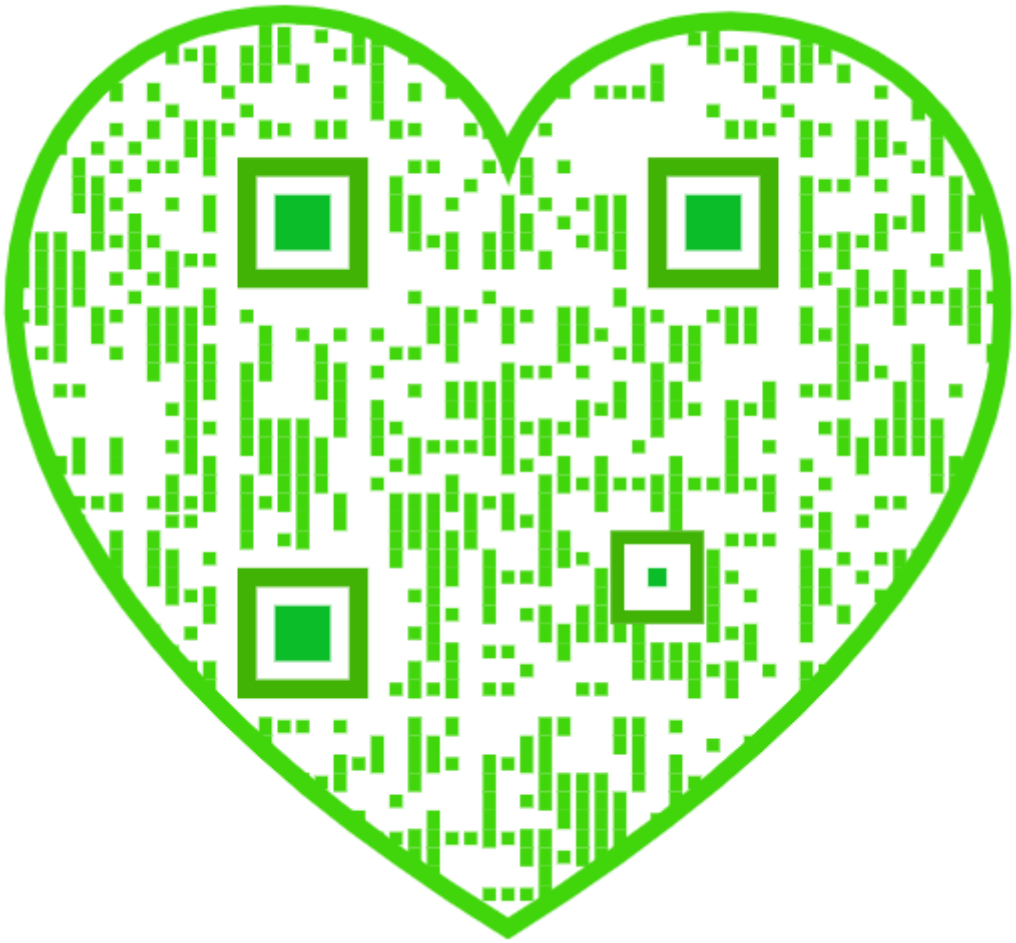

Canal had 564 miles of main line and 2,050 miles of minor distributaries, and irrigated 519,022 acres of crops. From this it will be seen how important a line of irrigation this canal constitutes, and how urgent the reconstruction of the aqueduct was. The new aqueduct replaces one of much smaller size, viz., five spans of 35 ft., which was damaged by a high flood in October, 1884, and completely destroyed by another high flood in July, 1885.

The Kali Naddi, for the greater part of the year, is a very insignificant stream some 50 ft. in width only, but on the date mentioned it was swollen into a river a mile wide and in places 25 ft. deep.

In addition to the construction of the Nadrai Aqueduct, all the railway and road bridges below it were also destroyed, and many villages swept away.

The proportion of the foundation to the superstructure of the new Nadrai Aqueduct can be gathered from the fact that three-fourths of the expenditure of money and time were consumed by what is now hidden below the ground.

The foundations consist of 268 circular brick cylinders or wells, as they are always called in India, all sunk 55 ft. below the river bed. There are fifteen bays of 60 ft. divided into three groups of five each by abutment piers. The abutment piers consist of a double row of 12 ft. wells spaced 2 ft. apart and the ordinary piers of a single row of 20 ft. wells similarly spaced.

The wells are all sunk through a stratum of stiff yellow clay, averaging 15 ft. thick, into a substratum of pure sand. The wells are all hearted with hydraulic lime concrete filled in by skips, and in each pier the wells, by corbeling out the brickwork, are joined together for the superstructure of the pier.

The total quantity of well sinking was 15,019 lineal feet, or nearly three miles, and was executed by hand and steam dredging. It was commenced in May, 1886, and completed in May, 1888. The arching was commenced in November, 1888, and finished in April, 1889.

The well sinking and arching went on night and day, the work being lighted by ten arc lights of 2,500 candle power each. Now that the aqueduct is completed it forms a most striking object in the vicinity, and will, we hope, stand to bear witness in far distant ages to the beneficence of British rule in India and to the skill of our English engineers.

The solidity of the great arches and piers and the fine sweep of the bastion-like wings all unite to give an idea of vast strength and stability, while the monotony of such a large surface of facade is relieved by the effect of light and shade obtained by the bold corbeling out over the spandrels to form a support for a roadway on either side of the canal, and the long horizontal lines of the cornice and railings are broken up by a tower at each end and one at each of the abutment piers.

The wells were built up on wooden well kerbs laid *in situ*, at first in short lengths of 7 feet, and sunk by Bell's 2½ cubic feet sand dredger worked by hand through a nearly pure stratum of sand until the kerb rested on the clay, about 30 feet below river bed level; the remaining length of brickwork of 25 feet, with 8 feet of false work, was then added, and in the case of the 20 feet wells an additional load of 150–200 tons of scrap rails was imposed to force the kerb through the stiff clay stratum into the sand below. The dredging in and below the clay was performed by Bell's 40 cubic feet dredger worked by steam hoists.

The double row of 12 feet wells in the abutments and abutment piers were similarly sunk, and Bell's 10 cubic feet dredgers worked by steam hoists were employed to take them through the clay, but as there was no room for rails, additional weight was given by an extra length of 10 feet of false brickwork.

These double rows of wells, only 2 ft. apart, gave much trouble in sinking, owing to the tendency of the wells to draw together. The width of 149 ft. between the faces of the arches necessitated three shifts of the centring in each span; this was performed after a length of arch work had been completed by lowering the centering by sand boxes on to trolleys running on three parallel lines of railway, and the whole centering was then dragged forward or shifted to another bay *en bloc* by a steam hoist. Mr. W. Good was the engineer of the work.

Thirty-six Tons of Pennies.

There are 72,800 pounds of pennies encumbering the vaults of the Sub-Treasury. This is more than thirty-six tons, and the coins are still accumulating. There are 10,400 bags, weighing seven pounds each. The accumulation is partly the result of the general establishment of the penny in the slot machines. The headquarters of the companies owning these machines is in this city, and all the pennies are therefore sent here when the agents make their returns. The companies thereupon unload them upon the Sub-Treasury. The Treasury Department will send these pennies to be distributed among the country banks.

THE frying sound in the telephone is caused by induction from other lines, earth currents, and static discharges.

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THE UNITED STATES LEADS THE WORLD IN IRON.

The United States now takes the lead in the production of pig iron. The schedule for 1890 stands as follows, allowing for Great Britain and the United States 2,240 pounds to the gross ton; Germany, France, and other states, 2,204 pounds to the metric ton:

United States,	1890	9,202,703 tons.
Great Britain,	"	7,904,214 "
Germany,	"	4,563,025 "
France,	"	1,970,160 "
Sweden,	"	781,958 "
Austria-Hungary,	1889	816,156 "
Belgium,	"	832,226 "
Russia,	1888	612,000 "

It will be seen from the above that the American production for 1890 was more than sixteen per cent greater than that of Great Britain.

The recent report of the Commissioner of Labor says: Only twenty-five years ago Great Britain was so far ahead of all other countries in the manufacture of these products that her manufacturers and statesmen did not dream that she would ever have serious competitors in the world's markets. The iron and steel consuming countries of the world were supposed to be dependent upon her for Welsh rails for their railroads, the finer qualities of Scotch pig iron for foundry purposes, Low Moor and other favorite brands of plate iron for boilers, Crown and other choice brands of bar iron from Staffordshire, English drawn wire, English hoops and cotton ties, Sheffield cutlery and edge tools, and all kinds of iron and steel machinery, in the manufacture of which great skill is required. At that time the Bessemer steel industry had not been established in the United States, and its possibilities were not understood even in England, where it originated, and we had but just commenced to develop our rich stores of Lake Superior iron ores and to apply our excellent Connellsville coke to their reduction. Germany lagged far behind as a producer of pig iron and steel and all their products.

The basic process of manufacturing steel from highly phosphoriferous ores, with which Germany is abundantly supplied, had not then been invented. But Great Britain was busy making steel by various new and old processes; she had an abundant supply of cheap coal; she had long known the virtues of Durham and other coke; and she had a variety of iron ores in abundance everywhere.

Since those days the United States and Germany have rapidly and even phenomenally increased their production of pig iron and steel, and of all articles made from them. The whole world, indeed, has greatly increased its production of iron and steel in the last twenty-five years, a result which is largely due to the extraordinary development in that period of railroad enterprises in all civilized countries, and to the invention of the Bessemer process, which has made cheap steel rails and cheap transportation possible; but the United States and Germany have made more progress than any other countries, and very much more relatively than Great Britain.

AUTOMATIC CAR COUPLERS.

Although the vertical spring hook style of couplers has been extensively adopted and its universal employment urged by car builders, the automatic couplers of the link and pin style seem to find most favor with brakemen and switchmen. They are the men who are obliged to work and deal with the couplers, and know what they are talking about. At the recent meeting in this city of the National Committee on Safety Appliances, Mr. D. B. Sweeney, of the Trainmen's Aid Association, favored the link and pin type. The vertical hook was too dangerous. They had to go between the cars to open the knuckle. The uncoupling apparatus was always broken. With the link and pin they knew when a car was cut, but when they threw up a lever they could never tell whether it would open or not. There was nothing better than a link and pin.

Mr. John A. Paul, editor of the *Switchmen's Journal*, described vividly the duties of the yard and switchmen, and the difficulties they labored under. Something should be done for them. The railroads were, he thought, doing all they could for them. He had many years' experience in yard work, and preferred the link and pin. The conditions under which these men worked were getting worse, and legislation was necessary unless the railroads accomplished more. A greater number of men were hurt every year. If nothing but vertical planes were used, they would still have to go between the cars—they were out of order so much. He believed the link and pin could be as automatic as the vertical plane. Yet, if all cars had vertical plane couplers, the conditions would be a thousand times better than they were to-day. The switchmen favored uniformity.

Mr. Heberling, of the Switchmen's Aid Association, said that they favored a uniform link and pin type or a uniform drawbar, anyway. If two cars of the M. C. B. type were set together without opening the knuckles, they were sure to break. Give them a uni-

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form drawbar of some kind, and it would save the lives of many men.

Mr. Roach, of the same association, followed, speaking of the danger of coupling the link and pin with the M. C. B. type. All of the new type couplers were a detriment and annoyance to the switchmen.

J. T. Chamberlin, master car builder of the Boston and Maine R.R., said that their employes who had spoken knew better what was wanted than the officers. The men of his road all favored the link and pin type of coupler. The vertical plane drawbars had broken badly on his road, and now they had none.

Wm. McWood, of the Grand Trunk R.R., said that, personally, he was opposed to the vertical plane type. The switchmen's views coincided with his. He did not think the M. C. B. type gave good satisfaction. The pin still remained, and if it became bent the knuckle would not work. Neither were the knuckles interchangeable, which was a serious objection. More satisfaction and better results could be had from a good automatic link and pin coupler.

Commissioner Rogers asked: What can we do? Shall we go back to the link and pin, or compel the adoption of the M. C. B. type? Mr. McWood said he would not like to anwer that question.

Col. H. S. Haines said the vertical hook type was defective as long as the knuckle had to be opened by hand. But a majority of railroad men felt that the M. C. B. type of coupler had come to stay.

Mr. M. N. Forney outlined the difficulty the Master Mechanics and Master Car Builders' Associations had experienced in arriving at standards on anything, and told what had been done in adopting the M. C. B. type of coupler. Also the trouble in keeping the various parts in stock. No organization could say what coupler was complete and perfect. A forced adoption now would mean a device imperfect and incomplete, and would stop progress. The best couplers of to-day were all defective. Investigation and progress would settle this in time.

From the information placed before the committee, it appears there are 1,200,000 freight cars in the United States, of which 200,000 are equipped with the M. C. B. vertical plane spring hook couplers. It costs $25 a car to put on this form of coupler. To equip the entire rolling stock would cost fifty millions of dollars.

The number of locomotives in this country is stated to be 27,150.

For the year ending June 30, 1890, 300 railroad employes were killed in coupling cars, and 7,841 were injured.

OIL FUEL UNDER STATIONARY BOILERS.

Oil fuel, though for a long time used with success in forges for heating iron and steel, it is within comparatively a recent period that users have become convinced of its economy for use under boilers. Among its advantages are increased intensity of heat, lessening of labor and riddance to ashes.

The *Safety Valve* recently obtained a statement of results from those who have been using various types of oil-feeding apparatus for this purpose. Out of a total of 35 users distributed over the country who furnished our contemporary with their experiences with oil fuel, only three have abandoned it, and these because situated close to the coal mines, where coal or its refuse is to be had for scarcely more than the cost of carting it away. The first of these, an iron company of Sharpsville, Pa., discarded oil, and now use gases from their blast furnace for raising steam; the limited amount of fuel required in addition being more economically supplied by the cheap coal of the vicinity. The second, a salt company, of Le Roy, N. Y., say that in estimating the difference in cost between oil and coal, they weighed all the coal used under one of their 150 horse power boilers for 15 days, which proved to be 110½ gross tons of hard coal dust costing $1.70 per gross ton. They then put in two oil burners and burned one tank of oil. It lasted 180 hours steady burning and cost two cents the gallon. This they calculated made the cost of oil 88 cents per hour and coal a little more than 52 cents per hour. Then they tried a better type of oil burner and did still better, but it could not compete with coal at $1.70 a ton.

The third was an iron works company, of Erie, Pa. They use the cheap slack coal of the vicinity, and oil fuel could not, they found, compete with it. Against this thirty-two witnesses appear, not, of course, so favorably situated for cheap coals. Few of them seem to have adhered to the type of oil-feeding apparatus they started with, but all have had such success with oil fuel from an economical standpoint as to lead them to pin their faith to it.

A rolling machine company, of Fitchburg, Mass., say their oil fuel costs them 10 per cent less than coal or coke and that they save from 25 to 50 per cent in time and make similar gains in point of production. A maker of mowers and reapers, of Akron, O., says oil fuel costs him not much, if anything, over one-third what he used to pay for coal. The oil is stored in a large underground tank located close to the railway track, and is drawn from this tank and fed to the burners by a small rotary pump. It saves him what used to be a large cost for labor, handling coal and ashes, and he no longer needs a fireman. A bicycle making concern, of Hartford, Conn., say that the use of oil in their furnaces has resulted in very largely increasing their product with a less number of men.

A drop-forge works, of Gloucester, Mass., do not find any difference between the cost of coal and oil, but "the oil fuel needs no attention, once it is started, and will run all day without ashes, clinkers," etc.

A bicycle manufacturer, of Toledo, O., says he is unable to speak as to the comparative cost of oil and coal fuels, as he never got anything like the amount of heat from coal that he is now getting from oil, but is sure that oil is the cheapest besides being more convenient and cleanly.

A steel company, of Steelton, Pa., finds no difference in cost between oil and coal, but saves largely in cost of labor.

A manufacturer of Plantsville, Conn., says: "In comparison with coal we save about 25 per cent, also gain from 10 to 20 per cent more work in same time."

A maker of agricultural implements, of Clayville, N. Y., says he effects a saving of about 40 per cent by the use of fuel oil in his furnaces instead of coal.

A bridge building company, of Toledo, O., pay one cent per gallon for oil delivered, the price of coal being $2.25 per ton. At these figures they find oil to be far cheaper.

An axle company, of South Egremont, Mass., do not find any difference between the cost of coal and oil, using the latter.

A saw company, of Middletown, N. Y., find oil fuel far cheaper than coal, and still more important to them, they get an intenser heat, the same being maintained steadily throughout the day, "thus," so they say, "improving the quality of our goods over that which it was possible to attain with coal as fuel. On the whole, we can say it is a grand success with us."

An agricultural implements company, of York, Pa., say: "We have made tests between oil, coal and coke. As bituminous coal is cheap here, there is no advantage in point of economy farther than the men can work more continuously and there is less lost time. We find oil fuel a good thing, all things considered."

A sand company, of Chicago, Ill., say: "We find it (oil fuel) very clean; it can always be regulated, always appears to be of uniform quality, and we find very little annoyance from its use, such as new grate bars and breakage of different kinds, which is always the case with the use of coal."

Irrigation in Arizona.

The proposition is to construct a diverting dam across the Gila River, at a point about twenty-two miles above Gila Bend Station, on the line of the Southern Pacific Railroad, where the stream has cut through a mountain range, leaving the rocky barriers standing opposite each other, and at a distance comparatively short. The site chosen for the dam is a good one, and affords conditions which could not be obtained at any other place on the river. The dam will be 1,800 feet in length, and about twenty feet in height at the channel. The dam will be constructed of piling and earthwork. It is not intended as a retaining dam, to impound a vast quantity of water, but simply to divert the water from its channel, and convey it in a great canal to the lands below the dam, which consist of 200,000 acres of as fine agricultural land as can be found in the Territory of Arizona. The overflow of the dam is to be 600 feet wide, though the natural channel is only 250 feet in width. The water will be taken out at a point above the highest overflow.

The canal will reach the railroad at Gila Bend station, on the line of the Southern Pacific. At that point it turns west, and lateral canals will be run out to every available point on the Gila River mesa.

It is one of the largest irrigation schemes on foot today, and will cost less money than any of those in California. The dam is estimated to cost $30.000, and will be completed by February 1.—*San Diego Union.*

The Silk Threads in Paper Money.

In spite of the skill and industry of counterfeiters, they have never made a bill which did not have one or more vulnerable spots. Some of the products of their handicraft may seem perfect to the untrained eye, but the expert will find that each one, like Achilles, has something lacking in his armor. Perhaps the feature of good United States Treasury notes which counterfeiters have found it most difficult to imitate is the two blue silk threads which run lengthwise through them. They are a little over an inch apart, and though sometimes almost invisible, they form part of every bill issued by the Government Bureau of Printing and Engraving. A. L. Drummond, chief of the secret service of the Treasury department, who has had a long experience with counterfeiters and their wares, explained to a *Tribune* reporter recently why it was so difficult to copy good bills in this respect.

"In the first place," he said, "the silk threads are put in the paper when it is made at the factory. To make paper of the kind used by the government requires a big plant and lots of capital. So counterfeiters are kept out of it. Even if they had the necessary money, they wouldn't be fools enough to risk it all for the chance of making bogus bills. It would be exceedingly unprofitable for a paper manufacturer who already has a factory to make the paper, because to do so is a penitentiary offense."

Mr. Drummond then showed the reporter a counterfeit two dollar bill, which had a single thread running lengthwise through its center. "This is the only bad bill that I ever saw with a silk thread in it. Even this has only one thread instead of two, so it would not be dangerous to a skilled teller. I have never heard of more than two other bills like this one. It is easy to see that the counterfeiter split this note, put in his thread, and then pasted the two parts together again. The frayed edges showed that. The fellow must have been very stupid not to know that genuine money has two threads instead of one. An expert can easily tell when a bill has been split in two and pasted together again, so the silk threads would not deceive him."

Pyrophosphoric Acid as a Manure.

BY DR. JAEHNE.

A process for preparing a manure containing pyrophosphoric acid consists in acting upon ferruginous phosphates with a weak solution of sodium bisulphate, evaporating to a paste, when a reaction takes place, calcium sulphate separating out. The mixture of sodium sulphate and monocalcic phosphate is heated until the pyrophosphate is formed.

As an example, a sample of ground coprolites having the following composition was employed:

Tricalcic phosphate	50·20 per cent.
Calcium carbonate	8·80 "
Ferric oxide	15·00 "
Aluminum oxide	1·00 "
Silica	20·00 "
Other constituents	5·00 "
	100·00 "

On treating this sample with one and a half times its weight of $NaHSO_4$ dissolved in 4 parts of water (constituting a solution of 1·162 sp. gr. or about 20° B.), and thoroughly agitating the mixture, the ferric oxide is not attacked, but the calcium carbonate is decomposed, and the phosphate converted into monobasic phosphate. The liquid after separating the $CaSO_4$ by settling tests 24° B. at 15° C.

By evaporating in the open, the air coming in contact with the pasty mass forms a yellowish salt, having the composition $2\,Na_2SO_4 + CaH_4P_2O_8H_2O$.

This salt can be utilized by mixing with all kinds of compositions. It can be obtained in a state of complete dehydration by heating it to the fusion point.

By so doing a compound, containing 4 parts of sodium sulphate, 1 part of calcium pyrophosphate, and 1 part pyrophosphoric acid is obtained, which is universally used as a manure.—*L'Engrais.*

Life-Shortening Occupations.

The *Medical Age* contains the following abstract from the *Journal of the American Medical Association*:

One of the curious features of modern life is the extent to which the most hazardous trades are overrun by applicants for work. The electric light companies never find any difficulty in obtaining all the linemen they need, notwithstanding the fact that the dangers of that kind of business have been demonstrated times without number. The men who work in factories where wall paper is made frequently joke one another over the tradition that a man's life, in this trade, is shortened ten years. A similar belief is prevalent in factories where leather papers are made, and among men who have to handle them, and whose lungs are said to become impeded by inhaling the dust arising from such papers. In certain other factories, where brass ornaments and fittings are made, the air is laden with very fine brazen particles, which are, when inhaled, especially irritating to the lungs. But one of the most singular advertised calls for employes that was ever printed appeared recently in a Connecticut newspaper, signed by a firm engaged in the business of building towers. It called for applicants only among those who are young, strong, and courageous, and closed by saying: "We warn all seekers for this job that it is of the most dangerous nature, and that few men continue in it more than a few years. In fact, it is almost certain death to the workman who follows this occupation."

A Word to Mail Subscribers.

At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

The bills for 1892 are now being mailed to those whose subscriptions come to an end with the year. Responding promptly to the invitation to renew saves removing the name from our subscription books, and secures without interruption the reception of the paper by the subscriber.

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BENZINE BLOWPIPE.

Dr. Paquelin has recently made to the Academy of Sciences two communications on the subject of some new apparatus, to which we believe it our duty to call the attention of our readers. Let us begin with the new mineral oil blowpipe, Fig. 1. This apparatus consists of two rubber bulbs forming a double bellows operated either by the foot or hand, of a metallic receptacle forming a carbureter, and of a blowpipe properly so called. The air expelled from the bellows traverses the carbureter and becomes charged therein, in passing through a plunge tube, with benzoline, the fuel of the Mille lamp. This product weighs from 700 to 710 grammes per liter. Mr. Paquelin employs also as a saturator an atomizer of the Giffard system, by means of which the air expelled by the bulbs, after atomizing the liquid combustible, becomes impregnated with its vapors. The carbureter is characterized by its measuring and mixing cock, the plug and shell of which present a special structure. In fact, the plug, whose travel is a half circumference, is provided on the surface with a channel inclined upon its axis. The seat is so channeled that a portion of the air from the bellows goes directly to the carbureter and another part directly to the blowpipe, becoming mixed in so doing with the hydrocarbureted air that issues from the carbureter. This point is indicated by the aspect of the flame of the blowpipe. This flame, in the first place either strongly tinged with white and fuliginous or else insufficiently supplied with hydrocarburet vapor, becomes purified to a greater and greater degree, until it assumes a very pure violet blue color of extreme clearness. It is then at its maximum of calorific intensity and its color has the brilliancy and softness of a water body-color painting. The combustible is thus utilized with its maximum of effect.

The blowpipe is formed of a single tube, like the jeweler's blowpipe. Its originality resides in the arrangement of its burner, which emits two kinds of flames—a central flame with a very finely tapering point and two small lateral flames in the form of petals or crown, according to the direction of their channels, these latter serving to light the first and keep up its activity.

The melting of platinum may be begun with the flame obtained. Upon placing a cock of ordinary structure between the bellows and the measuring cock, the height of the blowpipe flame may be graduated at will. We can also graduate the diametrical dimensions of it. To this effect, it suffices to modify the ratios between the section of the orifices of the burner and that of the lateral orifices. We thus obtain a series of flames, which measure from one millimeter at the base to three or four millimeters or more.

The blowpipe which we have just described will find an application in workshops and laboratories. Pyrogravure artists also will be able to make use of it for stumping their wood. Fig. 2 represents a new model of Mr. Paquelin's well known thermo-cauter. The carbureter is of metal as in the preceding model, but of octagonal section, and may be adapted, through a large hook, to a girdle between the body and clothing. Owing to this, it is possible to transmit to the combustive liquid a constant temperature. The rings of the hook serve as pinchers for dividing the cauter in case of griping. Here there is no plunge tube. The mineral oil is contained in sponges, and there is thus no upsetting of the liquid.

The charge of the carbureter suffices to supply the cauter for ten hours at the least. The products of combustion are expelled beyond the hand of the operator.

In the use of the large cauters, one of these products, steam, which is formed at a temperature of about 1,800°, is used for refrigerating the starting point and the channels that form a continuation of it. The handle is swept internally from one end to the other by a jet of air coming directly from the bellows, and which is divided at the lower part so as to form around the cauter holder three zones of isolating air.

These different conditions permit of reducing the handle of the instrument to such dimensions that it may be used as a crayon, and that the hand may be in close proximity to the operating field. It measures but 12 millimeters in diameter.

The older cauters widened out from the point to the base, but Mr. Paquelin has reversed that arrangement, for the new cauters widen out from the base to the point, the penetrating part only preserving its former dimensions. The instrument thus, with a great saving in platinum, possesses all its old advantages, and by this fact becomes a sort of *passe-partout* cauter.

The large cauters differ from the others in dimensions only in the diameter of the part formed of platinum.

Both the large and small cauters are mounted upon a piece which is less than six millimeters in diameter and all screwed to the same handle. The manufacturer has reduced the variety of the forms of the cauter to two main types—the handle and the point; and, taking into account the thermo-cauter of 1876, has arranged his new carbureter in such a way that the old cauters may be utilized.

The alcohol lamp of the first thermo-cauter is done away with. Use is made of but one kind of combustible—mineral oil. The cauter is lighted by any flame whatever or by means of the blowpipe described above, which serves also to clean it in case of need.

The applications of the Paquelin thermo-cauter are various, by reason of the forms and dimensions of the cauter. It answers the requirements of all kinds of surgery.—*La Nature.*

GERNSHYM'S KNITTED FABRIC.

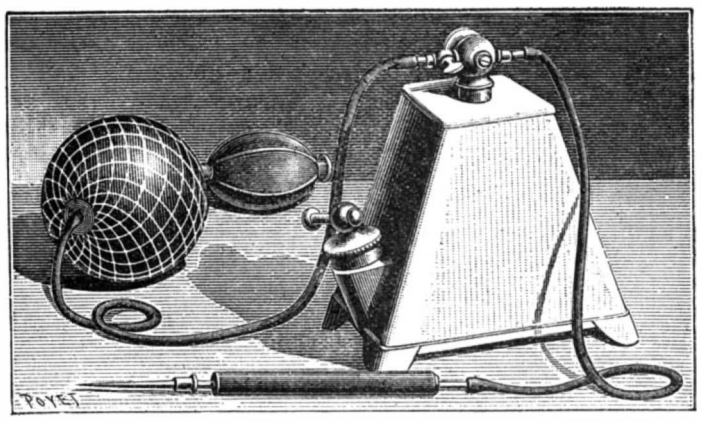

Fig. 1.—PAQUELIN'S BENZINE BLOWPIPE.

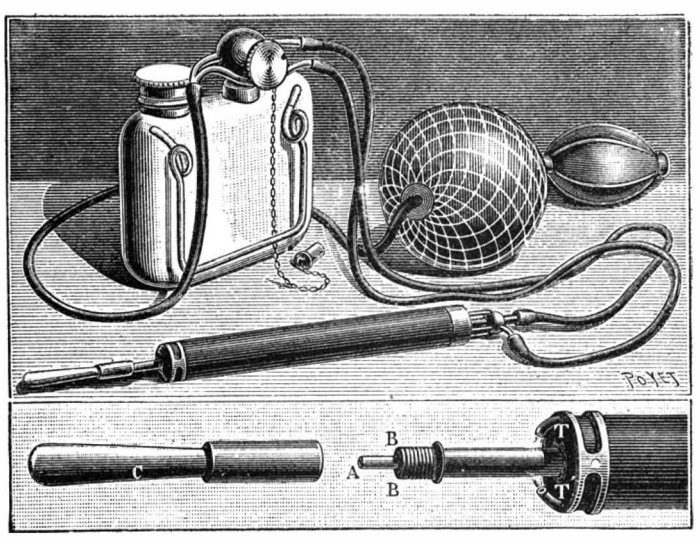

Fig. 2.—NEW MODEL OF THE PAQUELIN THERMO-CAUTER.

C. Details of the point of the thermo-cauter. A. Tube to carry carbureted air. BB. Tube for the return of products of combustion. TT. Condensation canals.

Pressure of Electrolytic Gas.

An interesting experiment has been lately made by M. Chabry, of the Societe de Biologie, with regard to the pressure which can be produced by electrolytic generation of gas in a closed space. While the highest pressure before realized in this way was 447 atmospheres (Gassiot), M. Chabry has succeeded in getting as high as 1,200, or 18,000 pounds to the square inch; and the experiment was broken off merely because the manometer used got cracked (without explosion). The electrolyzed liquid was a 25 per cent soda solution. Both electrodes were of iron; one was the hollow sphere in which the gas was collected; the other an inner concentric tube. The current had a strength of 1½ ampere, and was very constant during the experiment, which was merely one preliminary to a research in which very high pressures were desired.

AN IMPROVED KNITTED FABRIC.

Mr. Max Gernshym, of the firm of Henry Gernshym & Bro., manufacturers of cardigan jackets, No. 85 Franklin Street, New York City, having mills at Nos. 32 to 50 Stockton Street, Brooklyn, N. Y., has recently patented a new knitting machine for making tubular knit fabrics. The fabric is used for producing a new style of highly ornamental garments, such as cardigan jackets, as represented in the annexed cut.

The back of the garment is of the ordinary style, made with plain ribs formed with cardigan or other stitch, while the front is knitted to produce artistic designs to heighten the appearance of the garment, without impairing the quality of the goods, but, on the contrary, making a more durable and better fitting garment. Buyers of such goods, who are always on the lookout for novelties suited to their trade, should not fail to inspect the line of garments made by this new invention. On this machine all grades of cardigan jackets are produced.

Damage to Cloth.

A case of more than usual interest to makers and users of cloth has recently been decided in the Sheriff Court of Glasgow. The pursuer was Mr. Jas. Dyson, muslin manufacturer in Manchester, who got some gray cloth made to order by a manufacturing company. On delivery the cloth was examined, but not analytically, by Mr. Dyson, and sixty-four pieces were sent to Messrs. A. Macnab & Co., calico printers, near Glasgow, to be printed with handkerchief designs. Messrs. Macnab, in accordance with their usual process, singed the cloth with a gas-singeing machine and then wet it with cold water by means of a bleaching machine preparatory to bleaching. In the process of wetting the cloth several pieces burst in the washing machine, and on examination it was discovered that the weft of the cloth was sound and that the damage was caused by the warp having given way. The cloth was returned to Mr. Dyson and he then raised an action against Messrs. Macnab & Co. for its value, amounting to about £75, alleging he had supplied good cloth and that it was destroyed by Messrs. Macnab through carelessness and negligence in the process to which it had been subjected. The trial lasted two days, and the pursuer endeavored to show that the cloth as delivered to Messrs. Macnab was good, sound, merchantable cloth and that it had been damaged in the process of singeing, either by inequality in the gas jets or by one side of the cloth being subjected to greater heat or to greater tension than the other. The defendants, on the other hand, led proof to the effect that their machinery was in good order and condition, that the gas jets were all equal, that it was impossible for one side of the cloth in the process of singeing at their works to be subjected to a greater heat or to a greater tension than the other, that even assuming one side was subjected to a greater heat or tension than the other, the weft and warp would in that case both be damaged, whereas in the cloth in question the warp only was damaged, that the cause of the damage, therefore, must be something in the warp, which was not in the weft, that the warp which was subjected to chemical analysis contained both chloride of zinc and chloride of magnesia, that the weft was free from these ingredients, and that chloride of zinc and chloride of magnesia when subjected to heat, such as the cloth would be subjected to in the process of singeing, could tender cloth, and that the cloth was tendered in the singeing through the warps containing these chemicals and not through the defendants' carelessness or negligence. Mr. Sheriff Guthrie, before whom the case was tried, found for the defendants.

Depilatory Powders.

Dr. Clasen says (*Monatshefte f. prakt. Dermat.*, 1889, ix. 541) that among the best depilatory powders are sulphohydrate of sodium and sulphide of barium. As to the sulphohydrate of sodium, he says that used as a paste, one part to eight of water, and allowed to remain on for a very short time, it acts well. But it deteriorates very rapidly and is dangerous to give to a patient, as it is quite capable of producing scars. The sulphide of barium is a safer powder for the purpose. It may be used by mixing 50 parts of it with 25 parts each of starch and oxide of zinc. This is mixed with water so as to form a soft paste and spread upon the face. After ten minutes it is scraped off, and leaves a smooth skin.—*Medical Tribune.*

DOCTORS say a healthy adult should eat at least ten ounces of meat each day.

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New Automatic Electric Weighing Scale.

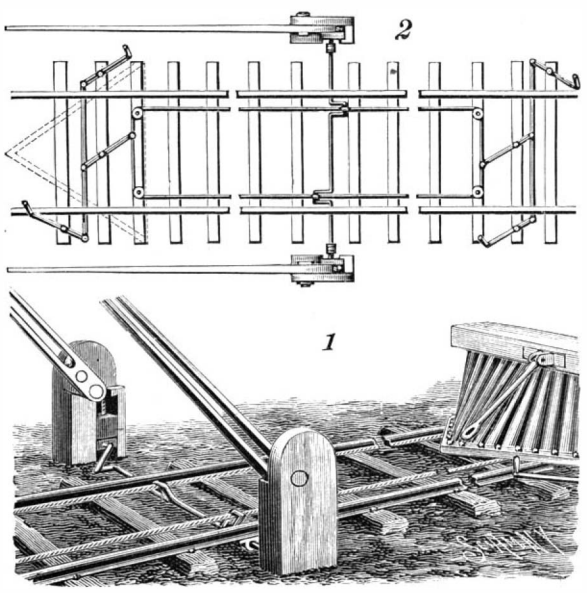
A patent has recently been issued to The Electric Scale Co., Covington, Ky., for an invention calculated to greatly facilitate the weighing of merchandise, etc., besides procuring more accurate results than are possible where the poise is manipulated by hand.

In this improved scale the counterpoise is moved lengthwise of the beam by a screw actuated by an electric motor attached to the scale beam, the motor being provided with a field magnet placed in a shunt circuit, the armature connections being furnished with a pair of contact springs for receiving the actuating current from either of two pairs of fixed contact points, the electric connections of the contact points being oppositely arranged with respect to each other, so that the current in the armature is reversed when the contact springs are shifted from one pair of points to the other, thereby causing the screw to revolve and shift the poise according to the position of the scale beam.

By means of this arrangement accurate results are quickly arrived at. The beam is provided with ticket-printing mechanism, which is capable of delivering a ticket upon which is recorded the exact weight indicated by the scale.

AN AUTOMATIC RAILROAD GATE.

The improvement shown in the accompanying illustration is designed to obviate the necessity of keeping watchmen to close and open gates at railroad crossings, such gates being, with this construction, closed and opened by a train passing in either direction. The barrier at each side of the track is fulcrumed in a post, the inner end of the barrier being connected with a weight sliding in the post, and the weight serving to hold the barrier in raised position. Sliding in guideways in the post below the weight is a block pivotally connected by a link with a crank arm on the outer end of a shaft which extends transversely under the track rails, where it is held to turn in suitable bearings. There are also two crank arms between the rails in this transverse shaft, one near each rail, arranged at right angles to each other, and both are connected with an endless rope or chain, arranged in a square, and passing over pulleys at some distance from the crossing in both directions, as shown in Fig. 2. Each end portion of this rope, between the pulleys, is connected with one end of a lever, pivoted on the ties, and the other end of the lever is connected with a transverse rod reaching to the outside of the rails, each of these rods being pivotally connected at its ends with short levers pivoted on the ties outside the track rails, and the short levers carrying each an arm or projection adapted to be engaged by the cowcatcher or other projection on the locomotive. The arrangement is such that when a train approaches, as shown in Fig. 1, the cowcatcher, engaging a short lever at one side of the crossing, shifts the transverse rod, whereby the rope is drawn upon to turn the cranks and cause the blocks to slide upward in the barrier posts, thereby allowing the barriers to swing downward and close the crossing. When the train has left the crossing, as shown in Fig. 2, the cowcatcher engages one of the short levers connected with the rope on the farther side of the roadway, shifting the cranks back to their former position, when the weights in the barrier posts slide down and the barriers are raised, opening the crossing. No matter in which way the train is passing, the barriers are thus automatically opened and closed, the improvement being designed to prevent the great number of fatalities constantly occurring at



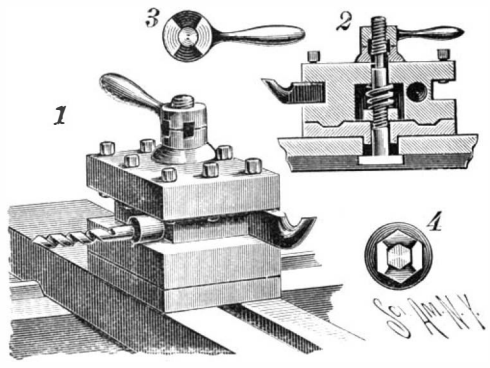
CLOSE'S RAILROAD GATE.

unguarded railway crossings where the travel is not sufficient to justify the employment by the companies of regular watchmen.

Further information relative to this invention may be obtained by addressing the patentee, Mr. Wilbur H. Close, in care of the Beck Steam Laundry Co., Atlanta, Ga.

A TOOL HOLDER FOR ENGINE LATHES.

The device herewith illustrated is designed to efficiently retain cutting tools in proper position to engage work on a lathe and facilitate the quick adjustment of a tool, or its release to substitute another tool therefor. It has been patented by Mr. Karl J. Pihl, of No. 35 Fifth Avenue, Brooklyn, N. Y. Fig. 1 shows the device in perspective, and Fig. 2 is a sectional side view. A transverse rib near the center of the base plate fits a groove in the top plate of the lathe slide rest, a standing bolt holding the parts together by an



PIHL'S TOOL HOLDER FOR ENGINE LATHES.

adjustable nut. The tool-holding block is centrally apertured to pass over the standing bolt, and has a recess in its lower surface around the adjusting nut, and affording a space above the nut for a stout spiral spring. On the upper surface of the base plate is a recess forming a rectangular shaped marginal channel, receiving a correspondingly shaped rib on the lower surface of the tool-holding block. There is a channel in each side wall of the tool-holding block to receive a lathe tool, held in place by set screws inserted from the upper side, there being a number of these screws provided for each side of the block, as well as an aperture to receive a drill. The upper portion of the standing bolt, where it projects from the tool-holding block, is hexagonal in form, and is loosely engaged by a locking washer, the top portion of the bolt being coarsely threaded to receive a correspondingly threaded handle bar. The engaging faces of the handle bar and washer are shown in Figs. 3 and 4, their notches being so formed relatively to the pitch of the thread on the bolt that the rotation of the handle forces the tool-holding block firmly down upon the base plate, and the entire tool rest is rendered rigid to support a tool at work. To release the block, the handle is partly revolved, when the block is forced upward by the central spiral spring, and the block may be revolved on the standing bolt to bring a different tool into position.

Dead Sea Water as an Antiseptic.

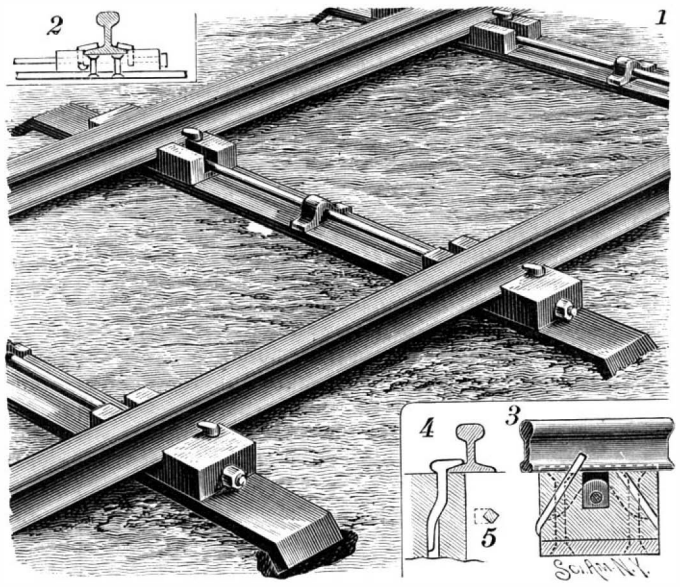
The *Daily News* Paris correspondent gives particulars of an interesting communication which has been made by M. de Chauveau in the name of the well known Pasteurian chemist, M. Lortel, who has long thought of turning the most accessible part of the Dead Sea into an Asiatic Runcorn, studying how, with a siphon, to bring to the top water from the bottom, which is heavily charged with calcium salts and bromide of magnesium. Another of his ideas was to export water from the Dead Sea as an antiseptic for use in hospitals, it being reputed mortal to every kind of animal life, and necessarily, as he supposed, to microbes. But a savant whom he consulted said, "Take care, there is hardly a fluid in nature in which a virulent microbe of some sort may not find a good soil." He therefore cultivated various kinds of bacilli in the densest Dead Sea water that had ever been fetched to his laboratory. The diphtheria, measles, scarlatina, small pox, and other fell creatures of the animalcular world were experimented upon. All died but two, with which in forty-eight hours the fluid was alive. The one shaped like the clapper of a bell and the other like a tack nail with a round head were the microbes of tetanus and of gangrene.

A New Fluid for Natural History and Microscope Work.

Mr. A. Haly, of the Colombo Museum, has been experimenting with carbolicized cocoanut oil as a preservative. His experience, he states, seems to show (it does not do to speak too confidently in a climate like that of Ceylon) that it is one of the most perfect preservatives known, both for form and color. Cocoanut oil and carbolic acid freely mix in all proportions. The mixtures at present under trial are oil raised to the specific gravity of 10° and 29° below proof spirit by the addition of acid. While the gum and glycerine process is absolutely useless for any animals except certain families of fish, this mixture is good for every kind of vertebrate. The most delicate frogs are quite uninjured by it, and snakes undergo no change. The delicate plum-like bloom on the geckoes, the fugitive reddish tint on such snakes as *Ablabes humberti*, are beautifully preserved by it. Another most important use is in the preservation of large fish skins, which can be packed away in it for an indefinite period, and mounted when wanted. These skins do not require varnishing, neither do they turn brown, but although, of course, they do not preserve their sheen like fish in the oil itself, they always maintain a silvery and natural appearance, quiet different from that of ordinary museum specimens. Species prepared in this way would form a most effective exhibition. It appears also to be a most excellent preservative for crustacea and the higher orders of arachnids, and also for centipedes; but it has proved a failure for marine invertebrates in general. Its absolutely unevaporable nature makes it invaluable in a tropical climate, quite apart from its other qualities. The acid also enables cocoanut oil and turpentine to be mixed together, forming a splendid microscopic fluid, in which objects may be allowed to soak without any previous preparation, and in which they become very transparent. A minute species of crustacean, of the order Copepoda, and the leg of a fly, simply laid on a slide in a drop of this fluid, and covered with an ordinary covering glass, without any cell being made or cement employed, have lain on Mr. Haly's table unaltered for ten months.

A PRACTICAL, DURABLE, METALLIC RAILWAY TIE.

The improved metallic tie shown in the accompanying illustration has been patented by Mr. Ellison Saunders, of Austin, Texas. Its base plate is preferably made of wrought iron or steel, and has downwardly and outwardly turned ends, rail-supporting blocks of cast or malleable iron being secured to the base plate by rivets or bolts, as shown in Figs. 2 and 3. The two blocks of each tie are connected with each other by a tension rod, by adjusting the nut on which any desired strain may be given to the blocks and base



SAUNDERS' METALLIC RAILROAD TIE.

plate to prevent spreading of the rails, the base of each rail resting in a longitudinal recess in the block. Centrally on each base plate is a block, through which the tension rod passes, to prevent accidental displacement, the block being held in place by a rivet or bolt. The rails are secured in their seats in the blocks by spikes driven as shown in Fig. 3, the point of the spike being clinched against the outer side of the block, while another form of fastening is shown in Fig. 4. In this case the apertures for the spikes are made with a bend and twist, so that the upper half is out of alignment with the lower half of the aperture, as shown in Fig. 5. The ordinary spike, driven in such a block, follows the shape of the aperture, and is bent at the middle and twisted in for its lower half, so that the spike is not liable to get loose. On curves or switches the guard or switch rails are fastened on an extension of the block, formed with a recess under the rail for the nut or head of the tension rod.

This tie has been in practical use for five months on a portion of a trunk line railway in Texas, where the work is very heavy, and is said not to show any evidence of wear, but to be still as firm as a rock, while wooden ties at the same point have had to be retamped and respiked. A yet more comprehensive testimonial is that of Mr. Robert White, Supervisor at the Grand Central Station, New York City, who writes, under date of October 24, 1891: "I have had some of your metallic ties in use in the yard at this station for the past three months, at a point where some of the largest engines pass over them each day, with a large number of switching engines and cars. They have had no attention paid to them since being put in, and still remain in perfect order. The spikes have not started, but are the same as when put in."

THE product of tobacco in Europe is nearly equal in quantity to the average production of the United States.

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Vital Energy and Electricity.

Thomas A. Edison has spoken his mind, touching energy, as follows:

'Of course there is a source of energy. Nature is a perpetual motion machine, and perpetual motion implies a sustaining and impelling force.

"When I was in Berlin I met Du Bois Reymond, and, wagging the end of my finger, I said to him, 'What is that? What moves that finger?' He said he didn't know; that investigators have for twenty-five years been trying to find out. If anybody could tell him what wagged this finger, the problem of life would be solved.

"There are many forms of energy resulting from the combustion of coal under a boiler. Some of these forms we know something about in a practical way, but there may be many others we don't know anything about.

"Perhaps electricity will itself be superseded in time, who knows? Now a beefsteak in the human stomach is equivalent to coal under a boiler. By oxidation it excites energy that does work, but what form of energy is it? It is not a steam pressure. It acts through the nerve cells, performs work that can be measured in foot pounds, and can be transformed into electricity, but the actual nature of this force which produces this work—which makes effectual the mandate of the will—is unknown.

"It is not magnetism; it doesn't attract iron. It is not electricity—at least not such a form of electricity as we are familiar with. Still, here it is necessary to be guarded, because so many different forms of electricity are known to science that it would be rash to say positively that we shall not classify vital energy as a form of electrical energy. We cannot argue anything from difference in speed. Nerve force may travel as fast as electricity, once it gets started. The apparent slowness may be in the brain. It may take an appreciable time for the brain to set the force going.

"I made an experiment with a frog's leg that indicates something of the kind. I took a leg that was susceptible to galvanic current. The vibration produced a note as high as a piccolo. While the leg was alive it responded to the electrical current; when it was dead it would not respond. After the frog's leg had been lying in the laboratory three days I couldn't make it squeal. The experiment was conclusive as to this point: The vital force in the nerves of the leg was capable of acting with speed enough to induce the vibration of the diaphragm necessary to produce sound.

"Certainly this rate of speed is much greater than physiologists appear to allow, and it seems reasonable that there is a close affinity between vital energy and electricity. I do not say they are identical; on the contrary, I say they are very like. If one could learn to make vital energy directly without fuel, that is, without beefsteak in the stomach, and in such manner that the human system could appropriate it, the elixir of life would no longer be a dream of alchemy. But we have not yet learned to make electricity directly, without the aid of fuel and steam.

"I believe this is possible; indeed, I have been experimenting in this direction for some time past. But until we can learn to make electricity, like nature, out of disturbed air I am afraid the more delicate task of manufacturing vital energy so that it can be bottled and sold at the family grocery store will have to be deferred.

"Electricity, by the way, is properly merely a form of energy, and not fluid. As for the ether which speculative science supposes to exist, I don't know anything about it. Nobody has discovered anything of the kind. In order to make their theories hold together, they have, it seems to me, created the ether. But the ether imagined by them is unthinkable to me. I don't say I disagree with them, because I don't pretend to have any theories of that kind and am not competent to dispute with speculative scientists. All I can say is, my mind is unable to accept the theory. The ether, they say, is as rigid as steel and as soft as butter. I can't catch on to that idea.

"I believe that there are only two things in the universe—matter and energy. Matter I can understand to be intelligent, for man himself I regard as so much matter. Energy I know can take various forms and manifest itself in different ways. I can understand also that it works not only upon, but through, matter. What this matter, what this energy is, I do not know.

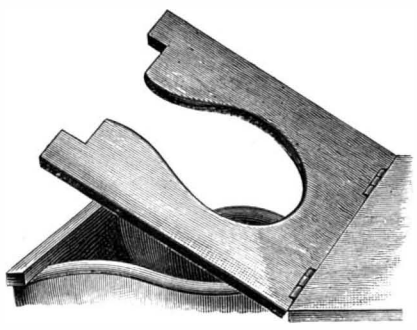
"However, it is possible that it is simple matter and energy, and that any desire to know too much about the whole question should be diagnosed as a disease; such a disease as German doctors are said to have discovered among the students of their universities—the disease of asking questions."—*American Engineer.*

Palpitation of the Heart.

This alarming and often very distressing symptom is often due to dyspepsia, caused by excessive mental or physical exertion. Sir Walter Scott was much subject to it. In his private journal, written in 1826, he says: "What a detestable feeling this fluttering of the heart is! I know it is nothing organic, and that it is entirely nervous; but the sickening effects of it are dispiriting to a degree. Is it the body brings it on the mind, or the mind that inflicts it upon the body? I cannot tell; but it is a severe price to pay for the 'Fata Morgana' with which fancy amuses men of warm imagination. In the country I drive it away by exercise. I wish I had been a mechanic, a turning lathe or a chest of tools would have been a godsend; for thought makes the access of melancholy rather worse than better. I have it seldom, thank God, and, I believe, lightly, in comparison with others."

AN IMPROVED WATER CLOSET.

The improvement shown in the accompanying illustration is especially designed to promote cleanliness,

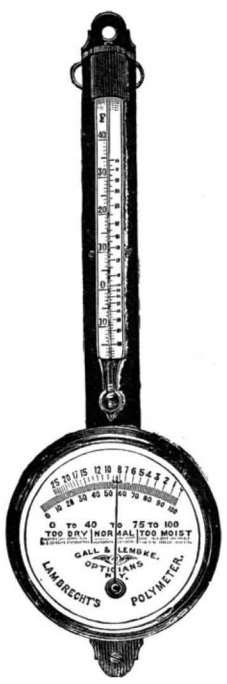


CHADBOURNE'S WATER CLOSET.

and is particularly adapted for use in the toilet rooms of public places. It has been patented by Mrs. Anne G. Chadbourne, of No. 100 Blue Hill Avenue, Roxbury, Mass. The bowl, which is preferably set up without cover or wood inclosure, is of porcelain or earthenware as usual, and has a wide forwardly extending portion at the top, terminating in a crosslip or strip-like part. This special construction of the upper marginal portion of the bowl in front operates, in conjunction with the form of the seat, to make a practically air-tight joint between the seat and bowl. With this form of closet, the body is kept from contact with the front portion of the seat and bowl, and the seat is kept clean.

LAMBRECHT'S POLYMETER.

This is a combination instrument for indicating the state of the atmosphere, its temperature, relative humidity or percentage of moisture, vapor tension, and dew point or absolute humidity. For meteorological purposes it has been stated by high authority to be more accurate than the wet bulb hygrometer, and far more convenient, as it indicates the relative humidity of the atmosphere on a dial which can be read as one reads the temperature on a thermometer scale. The thermometer on the stem of the polymeter gives the temperature of the air in Fahrenheit degrees, the same as any standard thermometer, but, as is well known, the amount of moisture which the air will carry, or the greatest possible vapor pressure without precipitation, varies constantly with the temperature. At 30° F., the maximum of vapor pressure is 0·165 in.; at 40° F., 0·248 in.; at 50° F., 0·361 in.; at 60° F., 0·518 in.; at 70° F., 0·733 in.; at 80° F., 1·023 in. Relative humidity is the percentage of moisture in the atmosphere at any degree of temperature, and this the polymeter gives by the index hand on the dial, zero being extreme dryness and 100 extreme saturation, or the air filled with moisture. The quantity of vapor which completely saturates the air at 32°, on having its temperature raised to 50° becomes only one-half saturated, and the index of the polymeter will point to 50 per cent; on a further rise of temperature to 70°, the amount of vapor remaining the same as at 32°, the index hand will point to 25 per cent or one-quarter saturation, which is too dry for human health and plants.



By the use of this instrument one can better calculate the prospects for fair or foul weather, the temperature and dew point or absolute humidity being given. Those who keep meteorological records, either for scientific or practical purposes, will find it a great aid, and for the physician it has a special value, as in a moment he or the nurse can ascertain the humidity of the air in his patient's chamber, and note whether it is too dry or moist. This knowledge in some diseases is very important. If the air is found too humid, a little fire in an open grate will remedy it. If too dry, the moisture may be increased by the evaporation of more water.

The instrument is made and sold exclusively in the United States by Gall & Lembke, 21 Union Sq., N. Y.

How to Preserve Potatoes.

The French Minister of Agriculture publishes the details of the process in the official *Bulletin du Ministere de l'Agriculture* for March, 1891. The following is a translation of the essential part of the scheme:

1. The method of preservation consists in plunging the tubers, before storing them away, for ten hours into a 2 per cent solution of commercial sulphuric acid in water; two parts of acid to 100 parts of water.

2. The acid penetrates the eyes to the depth of about one-fortieth inch (two millimeters), which serves to destroy their sprouting power; it does not have any appreciable effect upon the skin of the potatoes.

3. After remaining in the liquid ten hours the tubers must be thoroughly dried before storing away.

4. The same liquid may be used any number of times with equally good results.

5. A barrel or tank of any kind will do for the treatment. The acid is so dilute it does not affect the wood.

6. Chemical analysis shows that potatoes treated by this process are as nutritious and healthful after eighteen months as when freshly dug.

7. Potatoes thus treated are of course worthless for planting.—*Gerald McCarthy, N.C. Experiment Station, Raleigh.*

A Secure Base for Electrotype Plates.

Plates which offer little space for nails are usually fixed with very fine pins which very soon rust through in the perpetually damp wood, and before you know where you are, a plate is torn off its block by the inking rollers and crushed flat into the type by the printing cylinder. Sometimes the damage is even greater.

Every printer can rid himself of this nuisance in the following way: Take the plate off the wooden block, fit it with very strong wire pins, and bend these with nippers into hooks at the back of the plate. Of course these hooks must be less than type-high, and under no circumstances must the plate be bent. This plate is now to be placed on a table, and surrounded with type-high furniture slightly smeared with fat. Good, slow-setting Portland cement should now be mixed to a stiff consistency, poured into the form and allowed to project a little above the top.

This work is best done in the evening and the cast left to dry and set overnight. In the morning the electro and its block can be taken out of the form, after scraping away the superfluous cement with a brass rule. The block will then have been worked down to type height; that is, if a medium degree of warmth has prevailed in the room during the night, otherwise the drying will require a longer time. The cement block must now be allowed to dry another twelve hours in the air, and then placed twelve or twenty-four hours under water to harden.

A block of this kind has now been systematically treated for truth, warmth, cold, and damp, and will stand any amount of printing without alteration.

A plate mounted in this way, being anchored fast into the block, cannot now loosen; it can only be separated by destroying the block, but the cement is so cheap that that does not matter.

It must be admitted that the length of time required for making a cement block prevents their manufacture as an article of trade, but for the printer who can do this kind of work at odd moments this is no disadvantage. By this process one gets electro blocks which are far preferable to cast-on metal blocks and almost as durable.

The writer of this article has had electros thus mounted in use for more than three years, and asserts that they last splendidly.—*Paper and Press.*

Tone Signaling.

The last of a series of demonstrations of a new method of signaling was lately given at the Naval Exhibition, London, by the inventor, Mr. W. B. Chalmers. The apparatus consists of a series of ten immensely powerful reeds, arranged to give a complete diatonic octave with a note on each side, by means of which it is, of course, possible to produce a virtually unlimited number of short groups of notes standing for letters, numerals, or whole sentences, such as are most likely to be required in a fog, or at night by two ships meeting. In many cases three notes suffice for a message that with the ordinary fog horn using the Morse code would take about half an hour to transmit. The first strains of the various national hymns are, of course, used to declare the nationality of the ships using the code, and some of the groups of notes are very happily chosen. For instance, the minor cadence, C, B, A, standing for "I am in distress, stand by me," may almost be said, in the words of the analytical programme, to "speak for itself," and a cheery phrase for "I will send a boat to you" is scarcely less obvious. There will probably be little difficulty in finding men who can readily work the signals, as no musical complications are suggested, and for the use of unskilled ears a small set of organ pipes can be applied to the instruments, for purposes of verification.

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Failure of English Heavy Guns.

The defects which have recently developed in the heavy artillery supplied to our most modern battle ships should cause more than a little anxiety in the minds of the responsible officials connected with the Ordnance Department. The Benbow, which has recently returned to Chatham after an unusually short commission in the Mediterranean, is to have her two 110 ton guns removed and sent to the Elswick Ordnance Works to be strengthened. Only a few months since the weapons of the Sans Pareil were similarly treated, and it is well known that the heavy guns of her sister ship, the Victoria, are not altogether perfect, one of them, in fact, having the inner tube cracked near the muzzle. In each of these ships the guns are all of the same type, and seem to suffer similarly after the firing of a few rounds with the service full charge of powder, which is 960 pounds. The life of one of these guns is officially recognized as being from 75 to 80 rounds, but in the light of actual experience it appears as if these monster weapons would be placed *hors de combat* through inherent weaknesses long before the theoretical limit of their life had been reached. Drooping of the muzzle and cracking of the inner steel tubes are the primary evils engendered, but these evils are sufficiently serious in themselves to render perfectly useless the vessels by which the guns are carried. The shifting of the outer tubes or coils near the muzzle is another fault which experience has shown might occur. This, however, is less serious, and may be easily remedied, but the more grave imperfections which appear to baffle our ordnance officials ought to be subjects for strict investigation.

It has been suggested by an eminent authority on naval matters that one of these guns should be treated just as it would probably be used in actual service, and be fired for a large number of rounds until it was incapable of further use. Knowledge thus gained would be invaluable, and would no doubt prove a key to the solution of the erratic behavior of these monster weapons. Not a few experts contend that they are defective in longitudinal strength; others assert that they are both rifled and projectiled incorrectly. The total length of the 110 ton gun is 43 feet 8 inches, and the rifling adopted begins at the breech with an increasing spiral, which terminates about 80 inches from the muzzle; from this point forward to the muzzle the twist is uniform. Commenting on the rifling of heavy guns, some two years ago, Admiral Robert Scott, who is recognized as an authority on gun construction, made a few condemnatory remarks on the system in vogue, and submitted a few suggestions of his own, which, briefly summarized, were as follows: He would rifle his gun with a shallow-rounded grooving of uniform twist, and he would not force his projectile to accommodate rings on its base to the grooving, but would make his projectile to fit the grooving, and would give it long bearings, not of soft metal, but of iron, so that the whole length of it should be properly centered and supported in the barrel, and there should be no possibility of "wobbling." Experiments alone can either refute or confirm the various theories and ideas of different authorities, and it is only to rigid experimental investigation that we may look for a solution of the difficulties which seem to beset the production of a thoroughly reliable, accurate, and durable piece of heavy artillery.

Hitherto the 67 ton gun has been considered a perfectly trustworthy weapon, but the continuity of failures already referred to has been further augmented by the discovery of defects in two of these guns, one mounted in the battle-ship Anson and another carried by her sister ship the Howe. At the recent annual inspection it was found that the inner lining of the left gun in the after barbette of the Anson was cracked so seriously that the vessel was ordered to Portsmouth, on the completion of her refit at Devonport, to have the damaged gun removed and replaced by another of a similar type. The Anson was commissioned in May, 1889, and since the gun was first mounted on board only about three dozen rounds have been fired, and the majority of these with reduced charges. The nature of the defect has been investigated, but the cause remains yet to be explained. A few days ago the Howe was engaged in firing practice off Portland, and since then a serious fault has been discovered in one of her after barbette guns, but whether the injury was caused at the time, or whether it existed previous to the firing practice, is not known. It is of such a character, however, that the vessel has been ordered back to Portsmouth that the gun might be overhauled. This weapon, too, has been fired comparatively but a few times. Past experience with the 110 ton guns has been anything but gratifying, but to have the confidence in the 67 ton gun so rudely shaken is of more serious moment, especially when there is no reason to assume that the defective guns of the Anson and Howe differ in construction or otherwise to the remainder of the same caliber now afloat, or to those already complete and in progress for the new battle-ships nearing completion, and that a similar disablement may occur at any time to any one of these weapons.

Our neighbors across the Channel have a large number of heavy guns afloat, and little or nothing of a serious nature has transpired in connection with them. In fact, the French authorities seem perfectly satisfied with their heavy pieces of artillery mounted on the Formidable and Admiral Baudin, which weigh 75 tons each, and an expert, in commenting recently on the perfection of engines of war, is stated to have said that "the French in guns and rifles are far superior to anything that Europe possesses." Can it be, then, that the principle or system of construction of our big guns is at fault? Whatever the cause of so many failures may be, it behoves our ordnance authorities to pause and consider, and to rigidly investigate the collapse of the guns of the Howe and Anson, as they belong to a type which will be supplied to the eight first-class battleships now building, and on these vessels may depend the future welfare of the nation.—*Industries* (*London*).

The Puerto Cabello, San Felipe, and Araure Railway.

A most important concession has just been restored to Mr. Henry F. Rudloff, C.E., a citizen of the United States, by special act of the Venezuelan government, dated August 28, 1891.

It is for a line of railway commencing at the port of Puerto Cabello and thence *via* San Felipe to Araure, supplemented by an extra concession to continue the line to Guanare, a total distance of 350 kilometers, Guanare being the capital of the State of Zamora.

A glance at the map of the American continents shows that the great mountain chain of the Andes or Rocky Mountains attains to peaks of greater elevation in Ecuador than in any other State throughout its entire course from north to south. From about the city of Quito a powerful chain or branch is thrown off from the main range to the northeast, and traversing the republic of Colombia, it passes through its capital Bogota, and through all the northern portion of Venezuela adjacent to the sea, terminating opposite to the island of Trinidad in the West Indies.

The general elevation of this mighty range of mountains is very great. In the State of Los Andes, Venezuela, within some ten miles of Merida, the capital, there is a group of snow-capped peaks, five or six in number, of from 16,000 to 18,000 feet elevation. The average height of the coast range skirting the Caribbean Sea is between 7,000 feet and 10,000 feet.

Throughout the whole of this extensive chain of mountains, which may be taken at from 1,500 to 1,800 miles long, there are only two passes from the Atlantic Ocean to the interior favorable for the construction of a railway. One is from San Felipe to Araure, the subject of the present letter, and the other is 200 miles further to the east, from Barcelona to Soledad, the latter being a point opposite to Ciudad Bolivar on the Orinoco.

A correspondent of *Engineering* says the line takes advantage of the best of the natural passes through the mountains to unite by a railway the navigable waters of the great Orinoco River and the finest seaport on the Caribbean Sea. The pass from San Felipe to Araure is wide and ample, like a large open valley, the main range from Colombia running into the sea at or near Incacas. There is no gorge or cañon to pass through, requiring heavy and expensive works. After San Felipe the mountains commence by degrees to resume their original height, and geologists say that they are of an entirely different age and formation.

As a harbor, Puerto Cabello needs no recommendation to those who know the South American coast. It is notably among the best and safest in the world. It resembles Curacao, Havana, or Rio de Janeiro, the entrance being narrow and deep, and the harbor entirely land-locked. The inner harbor is immense, but not much used by shipping, a limited portion only of the deep water, near the town and the entrance, being sufficient for the requirements of the port at the present time.

The summit elevation of the line will not exceed 1,200 feet, the divide between the Yaracui River and the Barquisimeto River being in the neighborhood of Yaritagua, a distance of about 75 miles from the Atlantic port. Plans of the line have been made and show that no gradients will be required over 1 in 50, or 2 per cent, so that the operating expenses can be reduced to a minimum.

In this respect the proposed railway will be a striking contrast to all other lines in Venezuela, starting from the coast, on all of which gradients of 4 and 5 per cent have been used for long distances, and in some cases the rack on the Abt system.

The population to be served by the new line is estimated at 525,000, or about one-fourth of the entire number of inhabitants of Venezuela. The districts through which it will pass are by far the most populous in the country. They include upward of fifty towns and villages of varying size and importance, besides "haciendas," or large landed properties, and small farms.

It is hardly necessary to point out that Venezuela produces most of the articles of prime necessity for human existence in any and all parts of the world, namely, coffee, cocoa, sugar, tobacco, rice, cereals, and cattle. The zone of country to be occupied by the railway is acknowledged to be the richest and most fertile in the before-mentioned products of all Venezuela, and on the plains of the Orinoco cattle abound in tens and hundreds of thousands. For these reasons the new railway cannot fail to have a brilliant and highly prosperous future.

The report on the estimated returns and earnings of this promising enterprise has been made by an eminent French engineer, and it exhibits most flattering prospects for the new line, from the very commencement. The lands adjacent to the railway, being in the valleys, are almost all cultivated and rich. An increasing traffic is certain to grow up with each succeeding year.

The mining interests, also, are considerable, but undeveloped. Gold, silver, antimony, coal and other minerals are known to exist, and copper is the main staple of the region. From the mining industry alone the company can look for handsome returns.

But the most important feature of the new line is its central position as a grand trunk line for the South American continent. The existence of this low pass in the mountains, opposite to the most northerly point of Venezuela, or indeed of South America, and leading directly to one of the finest of all known natural harbors, is a rare geographical fact, which is little known in Europe, and almost as little known in Venezuela itself. The advantage to a railway company of controlling such a territory cannot well be overestimated, because at no other point on the northern coast of South America can access to the sea be had from the interior under such favorable conditions: 1. For geographical position. 2. For harbor facilities. 3. For gradients and works on a railway.

The line when fully developed in the future has the incontestable prospect of being, as it most assuredly must be, the grand trunk intercontinental line for the South American continent.

The enterprise must be considered, in view of the exceptionally favorable conditions of the pass for gradients and for construction, as of importance not only for the Venezuela of to-day, but as the outlet to the sea in a few years' time of all the interior portions of Colombia, Brazil, Peru, and Bolivia, east of the Andes. The policy of the company should be to push on as speedily as possible beyond Guanare to Barinas, and skirting the Cordillera on the flat grounds of the upper Apura and the Meta, to reach Bogota, the capital of Colombia, from the east.

Explorations have been made, and surveys of the upper regions of the Meta, which prove that the task of arriving at the Colombian capital from that side is by no means a difficult one; whereas it is well known that attempts have been made for a long series of years to get there with a railway from the west, and so far without a particle of success, and even if it were to be accomplished from Honda, or any other point on the Magdalena River, the results would still be unsatisfactory in the highest degree. It takes from six to sixty days, according to the water, of tedious traveling by river steamer to reach Honda from Barranquilla, a journey fraught with all kinds of risks from shallow water, consequent delays, heat, mosquitoes, and every abomination which can possibly make traveling a burden and an undertaking to be avoided. From Barranquilla, travelers have to go by rail to Savanilla, a place which is no better than an open roadstead, where the ships have to lie at a distance of from one to two miles from the landing stage. This journey from the ship to the railway has to be done generally in a heavy sea and in an open boat, or at best a small tug steamer, under circumstances of the greatest possible discomfort.

By tapping Bogota from the east, as foreshadowed in this letter, passengers will be brought in palace cars, sleeping and dining cars, in forty-five hours from their homes in Bogota direct to the ship's side at Puerto Cabello, under conditions of the greatest possible luxury and comfort attainable in modern railway traveling.

The calculation is for a speed of 15 miles per hour. The number of ocean-going steamers which visit Puerto Cabello in the space of one year is upward of 400. Several first-class European lines send their ships to this port, the best known being the Royal Mail, the West India and Pacific, the Harrison Line (Liverpool), the Compagnie Grato Transatlantique, the Spanish Line (Lopez), the Hamburg-American, and others.

The Red "D" Line, of New York, runs regular steamers three times per month, affording by far the best, safest, and quickest communication between Puerto Cabello and the markets of the United States and Europe. The transit to New York by this line is accomplished in from six to seven days with unerring regularity, and to Europe an average passage takes from seventeen to twenty days.

To Get Rid of Fleas.

Place the common adhesive fly paper on the floors of the rooms infested, with a small piece of fresh meat in the center of each sheet. The fleas will jump toward the meat and adhere to the paper.

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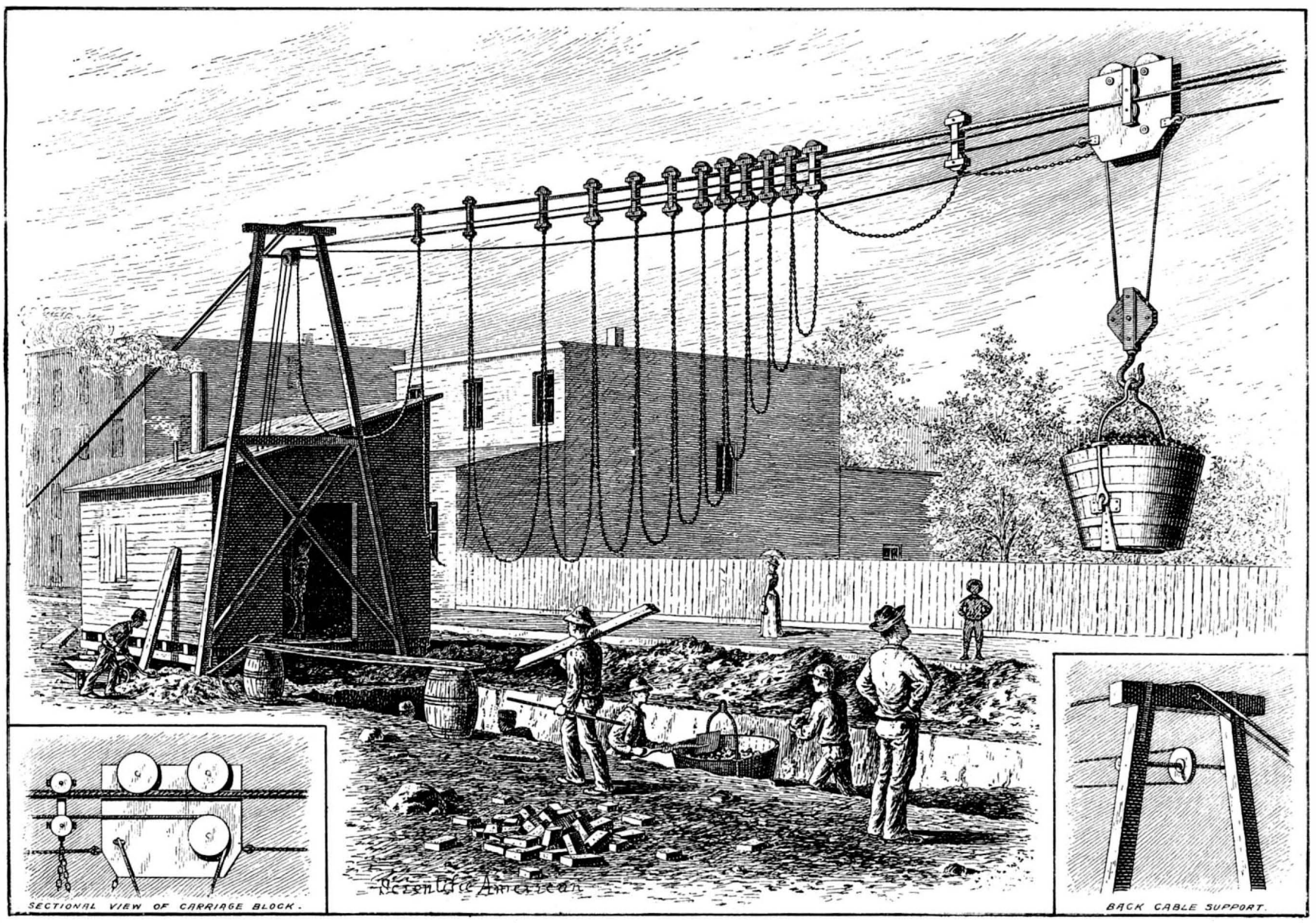
IMPROVED CABLE-CONVEYING APPARATUS.

The cable carrier shown in the picture has been proved in practice to effect a saving equal to the labor of 15 to 20 men in the construction of a 12 ft. sewer. The 1½ in. wire cable which carries the large and small carriage blocks is about 375 ft. in length, and its ends are anchored 5 ft. in the ground to a piece of 12 × 12 timber 8 ft. in length called the dead man. The cable and machinery attached to it is then raised from the ground by means of two 25 ft. wooden supports placed 60 ft. from each end of the anchor. The supports are made of 6 × 8 timber, and are 10 ft. in width at the bottom, tapering up to 3 ft. at the top. The working distance between these supports is 225 ft. The large wire cable is made of seven ½ in. strands, and the latter are each made of sixteen ⅛ in. wires. The cable when braced up has a fall in the center of about 3 ft. The upper trolley wheels of the large and small carriage blocks rest on top of the large cable, and the lower wheels of the small carriage blocks support the small ¾ in. cable, which raises and lowers the dirt bucket.

The framework of the large carriage block, shown in one of the small views, is about 2 ft. square and 2½ in. in width. It is made of ¼ in. wrought iron, and contains three 10 in. trolley wheels, the upper two resting on the large cable, while the small cable passes over the other and down through a 10 in. fall block which holds the bucket, and up into the carriage block, where it is connected to the lower corner of the framework. The small carriage blocks are about 1 ft. in height and contain two 4 in. trolley wheels 1½ in. in thickness. The blocks are connected together by means of ¼ in. chains ranging from 6 to 16 ft. in length.

As the large carriage block rolls along the cable, the small blocks follow as the chains straighten out. A small cable connected to each lower end of one of the sides of the large carriage block passes around a 12 in. sheave wheel at the top of one of the large cable supports and back again to the sheave wheels on the other support and down into the engine house, where it is connected to a drum working in the manner of an endless cable.

The dirt bucket is drawn back and forth by a Lidgerwood 20 horse power engine with 60 lb. of steam. Connected to the engine is a gypsy and an ordinary drum. The gypsy is used for carrying and the ordinary drum for raising and lowering the buckets. Both drums are worked with levers. The buckets each hold 10 sq. ft. or about 1,200 lb. A bucket can be raised, carried 225 ft., dumped, and brought back again in about half a minute. The machine carries the dirt and stone away, keeping the weight off from the sides of the excavation, and the refilling is speedily effected. The buckets will run back and forth 2 tons of dirt and stone at a time. The machinery weighs about 10 tons, and the total cost of the plant is about $3,000. Our illustrations were recently made from the apparatus when at work in Jersey City, N. J.



IMPROVED CABLE CARRIER FOR TRENCH DIGGINGS.

Printing Tints.

Mr. E. E. Wright gives in *Typo* (N. Z.) the following hints on the subject of tints—their method of use and their harmonies. By the term "tint" is understood a considerable surface of color applied to the paper as a ground work to the whole or portion of the job, to bring out some prominent feature in the design.

Tints may be divided into two classes: 1. Warm, such as salmon, orange, or reddish purple. 2. Cool, such as drab, gray, etc. Where a considerable portion of the job is to be tinted, and bright colors are to be used for the lettering, it is always safest to use a tint in which the primary colors do not appear. For instance, drab, gray, or slate produce a very good effect when used with almost any shade of red or green; but should the lettering be of black, blue, or any cold dark color, the tints should be warm—say orange, pink or lavender.

To obtain the greatest advantage from the use of any tint, its margin or edge must be clearly defined by a positive color, and where two tints meet, they should be divided by a darker line, which gives a finish to the job.

The tints most generally used, and which give a pleasing appearance to the work, are drab, blue, brown, lilac, pink, lemon, and green; but with a little study an endless number of tints and shades can be produced. In working more than one tint in a job care must be taken that the colors are in harmony, and that they are not too strong. The following, in pairs or triplets, produce a good effect: Blue and pink; pink and green; sage-green and brownish yellow, or buff; buff and greenish blue; buff and lavender; pink, sky-blue, and pea-green (this is a combination that looks well, but requires careful working); buff and light blue; buff, pink, and sky-blue, etc. These colors are for tints only, not for lettering. The choice of tints should be regulated by the positive colors used in the job, and some practice is required before the appearance of the finished work can be judged before the whole of the colors are brought together. One way by which some idea may be gained beforehand is to obtain sheets of paper of the primary colors, cut them into strips of suitable length and width, take a full sheet of tinted paper, and place the primaries on it, one or two at a time, and repeat the experiment with various tints. By this means, or by the use of water colors, the compositor or machinist can obtain a very good idea of the effect to be produced.

Tint work is at present so very little used in typography in these colonies that few offices keep a stock of tint inks on hand; but with the assistance of flake-white, or even of ordinary varnish, and the colored inks to be found in every well furnished office, excellent tints can be produced. In working tints it is only necessary to keep enough color on the rollers to give a solid impression. If too much is used, the colors of the next impression will be rough and ragged.

Green is one of the most serviceable of tints. It is a secondary color, a combination of blue and yellow, and tints may be prepared either by diluting a green ink or combining blues and yellows in various proportions. By the latter method an endless variety of tints may be produced, from brilliant emerald to those uncertain but beautiful shades which are neither blue nor green.

Drab is a cold tint, and is generally used for shadows. White, with a very little black, and perhaps a minute quantity of blue, will produce this color.

Blue is a useful tint, and may be diluted with white to any extent required. With the addition of a little yellow the peculiar tint known as "peacock blue" may be obtained.

Browns may be made from brown inks or in a great variety of ways by combinations of red and black with yellow or orange.

Lilac, lavender, and violet may be made by mixing red, blue, and white in various proportions.

Pink is produced by mixing white and rosine. For a permanent color use carmine.

The unlimited variety of tints and shades to be produced by combinations of colors in various proportions is illustrated in the case of dress fabrics, and many of the choicest fashionable tints could be imitated by the art printer, who would find it to his advantage to experiment in that direction. All tints dry lighter than they appear when freshly printed, and should therefore be worked slightly darker than they are intended to be. Wherever possible they should be tested in juxtaposition with the colors used in the text of the job.

A Successful Inventor.

It is not every inventor who is so fortunate as Mr. Louis Brennan. The Admiralty have paid the last installment of £16,000 to this gentleman, who has received much more than £110,000, which the government is supposed to have paid for his torpedo. Eight years ago he was paid a retaining fee of £5,000, and engaged for three years at a salary of £2,000 a year and expenses, in return for which he was to devote all his time to the development and improvement of the torpedo, and when that term was over he received for some years a salary of £1,500.—*The Practical Engineer.*

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THE OSTRICH.

Among the earlier references to this singular bird we may place with some interest the statement made in Xenophon's Anabasis, that there were on the Mesopotamian plains "all sorts of beasts, very many wild asses, and many ostriches." They could then, as now, only be secured by strategy, for the same ancient writer avers that "those of the horsemen who pursued them quickly stopped, for escaping they drew far off, using their feet in running and their wings, raising them like to a sail." Herodotus speaks of the ostrich, and Aristotle refers to the ostrich in numerous places.

Though remarked and studied for so many centuries that it might be supposed that its habits and traits were among the most familiar incidents in natural history, yet the ostrich to-day is not in all the details of its life fully understood, so difficult does it seem to penetrate the domestic economy of our common animals. The ostrich enjoyed a much wider range in the past than it does to-day. It then was found in Syria, in Persia, and pushed the northern limits of its distribution up into Belochistan and Turkestan. The attacks of man have virtually circumscribed its home within the borders of Africa, and here upon the broad inland plains, the skirts of the Sahara, and the edges of Barbary it may yet be found, herding with the antelopes, mingled promiscuously among them, or in separate bunches, dotting the level land with its singular and plume covered forms. Sclater has remarked of the group of the *Struthionidæ*, to which the ostrich belongs, that it forms an eccentric and unique family, and, with a common expression, diverges so widely in its members that whereas the true ostrich (*Struthio camelus*) approaches among birds most nearly to a mammal, the apteryx or *kiwi* at the other extremity of the line suggests and possesses reptilian affinities. To this struthioid group belong also the American emus and the Ceramese cassowary. The ostrich lives upon fruits, vegetable products, succulent herbs and grass; the eggs of the hen are deposited in a circular cavity scraped in the sand, where, exposed to the heat of the sun, they are hatched, and, covered by the cock during the night, are protected against the depredations of prowling jackals. The bird is voracious and eats indifferently solid objects, stones and dirt, mingled with its customary food. Eggs scattered about the outside limits of their nests are said to be intended for the sustenance of the young, as they emerge upon incubation, since their tender stomachs would fail to digest the more refractory substances eaten by the large birds. The ostrich in Africa has been separated into two species, that of the north, with smooth eggs and flesh colored skin, and that of the south, with pitted eggs and a bluish colored skin, and this distinction has been finally fully accepted.

The Rev. Dr. Samuel Houghton has paid especial attention to the muscular mechanism of the leg of the ostrich, and has revealed the construction of that powerful member in a paper published in 1865 in the "Annals and Magazine of Natural History." The extraordinary speed attained by the ostrich, and the well known vigor which it can impart to its kicks, have made this portion of its anatomy of peculiar interest. Dr. Houghton regards the leg of the ostrich as a long rod, bent at four distinct points, which is suddenly straightened or elongated by the simultaneous contraction of all the muscles. The bird is thus thrown forward with a formidable impetus, and while the body of the bird is thus launched into the air, the complementary muscles that restore the flexed condition of the leg instantly reassert themselves, and, in conjunction with certain contrivances in the heel joint, fold the leg again, preparatory, as it touches the ground, at the next step, to another erection of the whole leg, with the effect of again hurling the great bulk of the bird forward in its projection through the air.

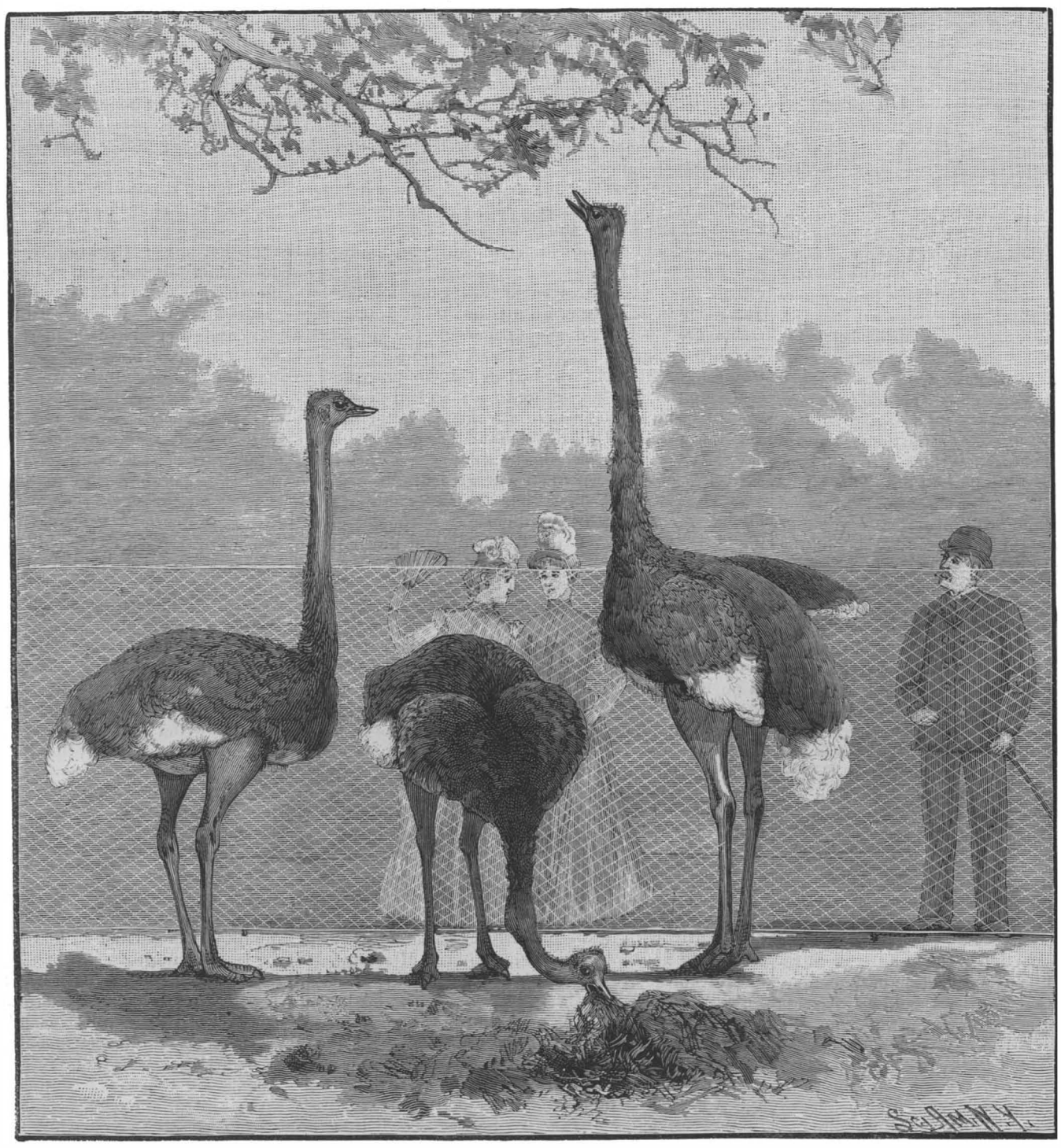
The gait of the ostrich emu, cassowary, or rhea in confinement appears particularly awkward, and suggests the limping effect of "string halt" in horses. "This unpleasing impression," says Dr. Houghton, "would be rapidly converted into admiration if one could see the bird in rapid motion over rough ground, springing from foot to foot, and bending, with the rapidity of lightning, the foot as it left the ground, avoiding skillfully and without an apparent effort the dangers of the rough soil." The ostrich, in its singular and effective progression, appears to touch the ground alternately on each side, and in a series of oscillating springs, whose rapidity causes its motion to appear direct, leaps with ease over rocks and shrubs of moderate dimensions.

The domestication of the ostrich in South Africa is only of some twenty-one years' standing. There was at first much opposition, and it was thought that the feathers of the domesticated birds would turn out to be inferior to the natural plume. In 1883, in South Africa, there were more than one hundred thousand tame ostriches. In 1880, $40,000,000 of capital was engaged in this business, and one hundred and sixty-three pounds of feathers were exported from the Cape, worth nearly $4,200,000. The birds are kept in inclosures, which, in a natural state, must be twenty or thirty acres in extent per pair. They breed at the age of four years, but produce plumes after their first year. The feathers are classed according to their character as wing feathers, white; female feathers, white; tail feathers, fancy feathers, black and white; black feathers, long, medium, and short; and, lastly, gray feathers.

The Cape plumes formerly took the sixth rank, after those of Aleppo, Barbary, Senegal, Egypt, and Mogodon. Now they rank very high. In 1882 a pair of breeders sold for $1,200, but in 1884 they could be bought for $200 to $250. Properly kept, a bird produces $50 worth of plumes per annum, to which must be added the value of the eggs and chicks. The ostrich lays a minimum of forty, a maximum of sixty eggs in a season, each weighing three pounds.

In America the raising of ostriches for industrial purposes began in southern California, at Anaheim, and has since expanded, but has scarcely reached a stage of assured success.

Our illustration strikingly shows a characteristic attitude of the ostrich in feeding. It is a study from life of some handsome specimens of this bird now in confinement at the menagerie in Central Park.



THE OSTRICHES AT THE CENTRAL PARK MENAGERIE, NEW YORK.

Test of Fireproof Materials.

A test of fireproof materials was conducted in Boston, on October 15, in the presence of a large number of persons especially interested. A building was constructed for the purpose in a vacant lot, the interior being divided into seven rooms, each about 5×15 feet in area, and lined with fireproof material. The material was put on by a number of manufacturers, each of whom protected the interior of one of the rooms according to his ideas of fire-proof construction, some using plaster, others fireproof paper, others specialties of their own make. The entrance to each room was protected by a fire door, tinned on one side and the edges. There was also an opening in the roof of each room. Inside of each there were suspended four links, one of lead, melting at 626° F.; one of antimony, melting at 842°; one of aluminum alloy at 1,292°, and one of brass melting at 1,850° F. The experiments were under the supervision of C. J. H. Woodbury, C. H. Goddard, O. S. Lord, and C. H. Rutan. About a quarter of a cord of dry hickory wood was placed in each room, and about half a cord in an effective position near the building. This wood was soaked with oil and the fires lighted. The fire burned nearly an hour before the building itself began to be consumed. By this time three of the links in each room had melted, showing that the temperature in each had risen above 1,292°. Later all the links melted, except one brass link in one of the rooms. In one hour and forty minutes after the fire was started the hose was turned on, and when the fire was wholly extinguished an examination of the building was made. It was found that all of the fire-proof materials used in the test had stood the experiment very well, but that some of the plastering had fallen, in cases due to the wooden backing being charred and thus leaving the plaster without support. —*Railway Review.*

ONE or more belts running independently on the top of another will add much to the transmission of power.

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Beet Sugar in Utah.

Among the new enterprises in Utah is the great beet sugar establishment at Lehi, with a capital of $1,000,000. It has proved a great success. The *Irrigation Age* says:

The main building is three stories high, 180 feet long, and has an average width of 84 feet. The annex, which contains the boilers, bone black house, and lime kiln, is 180 feet long and about 40 feet wide. Both of these large buildings are substantially built of brick. There are six beet sheds, 500 feet by 24, with a capacity of 14,000 tons of beets. The company has erected a boarding house, which is 30 by 65, with an annex 24 by 60, and furnishes accommodations for fifty people. There are four pulp silos, 180 feet long, 24 feet wide, and 10 feet deep. The coal bins are 48 by 250 feet. These figures throw considerable light on the magnitude of the enterprise to the average mind. The water supply of the factory is the lake, fed by natural springs, with a capacity of 4,000,000 gallons in twenty-four hours. Besides this there are eight artesian wells, from 60 to 135 feet deep, which furnish soft, pure water, and have a capacity of 500 gallons per minute. After examining the works the government decided to locate the internal revenue inspector and weigher on the grounds, and for their accommodation the company has erected a four-room building to serve as a laboratory and office.

HOW BEETS ARE MADE INTO SUGAR.

When the farmer brings the result of his season's toil in the beet fields to the factory, the beets are first weighed and then stored in the long sheds, which have been made frostproof by a double wall, filled with cinders and a roof covered with earth. As the beets are required at the factory they are thrown into a shallow sluiceway, which runs from the sheds to the factory and enables the beets to float from the point where they are received to the place where they are needed. They are taken from the sluiceway by a wheel elevator and dropped into a washer, which is a trough-shaped contrivance, with revolving arms. The beets are then thrown out automatically into a bucket elevator, which conveys them to the top of the building, where the cutter is located. This machine cuts the beets into slices about one-eighth of an inch thick, three-eighths of an inch wide and of various lengths. The sliced beets now pass from the cutter through a revolving chute into the great circular diffusion battery. This consists of twelve wrought iron cells, each holding about 126 cubic feet, and having an open manhole on top with swinging cover. The bottom is arranged to open and close by hydraulic pressure.

It is in this diffusion battery that the interesting process of separating the saccharine matter from the beet is performed. This is done by the use of water heated to a certain degree, from which it must not vary. As the water pours through the cells for the first time it carries with it about one-half of the saccharine matter, while the other half is left in the beet. The hot water is turned on ten times in succession, each time taking more of the sugar, until at last it has extracted all but about one-eighth of 1 per cent of the sweetness which the summer's sunshine has stored in the beet. The juice now flows to an automatic register, which registers the quantity and temperature of the juice and draws out a sample for use in the laboratory. From the register it passes to a heater, which is heated to 90° centigrade, and it then passes into the carbonators or clarifying pans, where a portion of the impurities are removed from the juice by the application of lime. Fortunately a majority of the impurities combine with this substance and settle at the bottom of the pan. The sucrate of lime is decomposed by pumping carbolic acid gas through the liquid, which forms the excess of lime into carbonate of lime. When this operation is completed, the whole contents of the carbonator, 180 cubic feet of juice, or 1,350 gallons, is pumped by means of a plunger pump, having a capacity of 8,000 gallons per hour, through a mammoth filter press. This removes the residue of the clarification, the juice being treated twice with carbonic acid and once with sulphurous acid. In the last process all of the lime is removed.

The diluted liquid is now concentrated in a quadruple effect evaporator to a 50 per cent solution. From here there are two operations. To make the very finest quality of sugar it is necessary to run it over bone black, which removes impurities that cannot be taken out any other way. After this process the liquor is as clear as water, and the juice is then boiled into sugar in a vacuum strike pan. This is a closed kettle, 10 feet and 6 inches in diameter and 23 feet high, and holds 35 tons of sugar. In this kettle the sugar is granulated, and forms a product technically termed melada, a mixture of molasses and sugar, 75 per cent of the latter. The sugar is then dropped into a mixer, which holds the entire contents of the kettle. The next step is to remove the sirup, which is done with Weston centrifugals. The sugar is then partially moist, and the moisture is removed by passing the product through a Hersey sugar drier. It then passes perfectly dry into the sacks, each of which holds exact 100 pounds. Here samples are taken, weighed, and marked by the internal revenue officials, and then at last we have the finished product of the Utah Sugar Company.

It has taken exactly thirty-six hours from the time the beet left the shed until the sugar is ready to sweeten your coffee.

Wherever any good industry like a beet sugar factory is located it greatly benefits the surrounding community, especially the farmers. Among the direct benefits which Lehi has received is the erection of a $10,000 hotel, a $7,000 bank building, and a number of residences and stores. Real estate has appreciated in value perhaps 50 per cent, and the town has gained 600 population in six months. Another good result has been the establishment of a local newspaper, and many other improvements are in prospect, such as a creamery, a new opera house, electric lights, and general town improvements. The creamery enterprise contemplates an investment of $50,000. On many pay days the company has distributed $10,000 in this community, and will soon pay out something like $180,000 to the farmers for beets. We have already brought here 1,000 tons of machinery, and we shall have to haul 4,000 tons of coal and coke from Pleasant Valley, Rock Springs, and points in Colorado. We shall also bring a great deal of bone black, or animal charcoal, from Eastern cities. Our shipments of sugar will be very heavy, and the railroads have already built three miles of new track in Lehi. Mr. Granger, our agricultural superintendent, will tell you how the industry has benefited the farmers. The factory has doubled the capacity of farmers to make a living. It increased the value of their land.

This is the first factory equipped with machinery made in the United States. All other beet sugar machinery is the product of European workshops. This is the product of American faith, American brains, and American labor.

The man who raises sugar beets has an absolute guarantee in advance of his market and his price. Contracts are made with the farmers in the spring, by which they agree to plant a certain acreage of beets from imported seed furnished by the company and to cultivate the crop according to a plan laid down, and then the company agrees to buy their crop for cash, at a certain price per ton. When the farmer understands the cultivation of this crop, he will get from fifteen to thirty tons per acre, which will give him from $75 to $135 per acre, at $4.50 per ton. The beet crop can be handled, including every expense, from time of planting to the time when the beets are laid down at the factory, for $40 per acre. After the first thinning, one man can take care of from ten to fifteen acres. For the first thinning a man must devote four or five days to an acre.

With irrigation the Utah sugar beet will stand first in the world—first in amount of saccharine matter, first in purity, first in tonnage to the acre. There are some things, however, it seems, difficult to make the farmer understand. The chief difficulty is his disposition to raise big beets. Now, the beet that contains the most sugar is the one that weighs from ¾ pound to 1½ pounds. Above that it ceases to increase in sugar in proportion to its size. A good average beet of this size will go 14 per cent in sugar and 80 per cent in purity. Beets weighing 4 to 10 pounds will show not more than 3 to 6 per cent of sugar and 45 to 55 per cent in purity.

These beets are of no earthly use to any factory, and yet almost every day some farmer comes to me triumphantly with a beet nearly as large as a parlor stove, and he thinks it contains a barrel of sugar. He has forced the growth of this beet by giving it lots of water, and by every other possible means, and he has raised a beet that we cannot afford to undertake to make into sugar.

Beets do not impoverish the land much. The constituents of the soil go largely into the leaves and crown of the beet, which are left on the ground after the harvest and subsequently plowed in. So that the farmer really returns to the soil in plowing the strength that has been drawn out of it by the growth of the beet.

World's Fair Notes.

The exposition attractions in the vicinity of the main lagoon entrance, just south of the great manufacturers building, are to be quite different from those originally planned. In place of the latter there will be a peristyle, 60 ft. wide and 500 ft. long, extending north and south and spanning the lagoon entrance by a grand arch. Ranged along this peristyle will be emblematic columns representing all of the States and Territories. At the north end of the peristyle will be placed the music hall, which for a time it was thought would have to be put on the wooded island. It will measure 140 by 200 ft., and will have an auditorium large enough to seat 2,000 people, with an orchestra of 75 pieces and a chorus of 300 persons. It will also have a rehearsal hall 50 by 80 ft., capable of seating 600 people. This music hall is designed to be used by musical talent and connoisseurs of the art rather than by the mass of people who will visit Jackson Park. It is intended that here shall gather the fine singers and instrumentalists who may wish to be heard and criticised by the best representatives of their art or profession.

The grand choruses and band concerts—the popular musical entertainments—will be held in an amphitheater accommodating 15,000 people or more. This will be in the extreme southern part of the park and, after the close of the projected musical programme, will be transformed into a live stock show ring.

The pier, extending 1,000 ft. into the lake, is already completed. At its extremity, in place of the casino, will be erected a tower 250 ft. high. This will be of iron, covered with staff, and will resemble a lighthouse in appearance. From its summit electrical displays of exceeding brilliancy will be made, and by means of electric "search lights" the grounds, or any particular portion of them, can be flooded with light on fete nights.

How the Other Half Does Live.

When it is pointed out that an alleged half of the world doesn't know how the other half lives, the speaker is apt to wear a wiseacre air characteristic of the thoughtful person. What is always meant by the remark is that the speaker himself professes not to know much of the daily life of the very poor or the socially predaceous. But there remains still a full half of the world of whose life it is safe to say that the supercilious fragment knows even less than it does of that of the very poor. This remaining half is so astonishing in its activity that a glance at it can scarcely fail to minister to the pleasure of the *Evening Sun's* readers.

Sweeping this active half of the world, then, with a glance, we perceive it engaged in figuring up the piston surface for a pumping engine and the diameter of an aqueduct pipe; tracking the bug to his lair and destroying his egg, exterminating mosquitoes and measuring earthquakes; making new probes to pull things out of folks' ears with; modeling creatures in clay and carving them in stone; designing World's Fair buildings for Chicago, and other buildings for Madison and uncounted other squares, and cathedrals for New York; measuring the women's diaphragms to show why their noses are red.

Disinfecting sewage and disengaging aluminum; intercepting the floating germ and setting him to slay the innocent rabbit; finding drugs whose tremendous potency mocks even the purple fluid in the apothecary's shop window; ridden by nightmares and fashioning women's garments after the vision; speeding house elevators and testing timber trees; determining the course, S.E. and by S., ½ S., which Sirius was sailing nine years ago when the light we get today set out from him; trying new crosses of blood for racehorses and fantail pigeons; painting impressionist pictures and composing music of the future and telegraphic cipher codes while mad-houses and suicides' graves multiply on every hand; applying liquid fuel and improving screw propulsion; identifying Sing-a-Song-of-Sixpence with the funeral chant over the body of Patroclus.

Finding out how cold the moon is, why water feeds the flame of burning oil, and observing the effect of electric light on trees, keeping them awake; photographing a wink and tracing the history of rain gauges; devising apparatus to test the adulteration of wine, and adulterants to beat the apparatus; devising better material for underclothing, new models of yachts, binnacles and oil-serving swabs to still storm waves, and improved methods of brewing beer; devising dynamite guns, mill worker's homes, and glue that doesn't unstick; determining the apex of the sun's way near Lyra and *not* Hercules; trisecting an angle and recording the chemical life history of Jerusalem artichokes.

Sounding the sea, hatching fish and finding out what kills the oysters; making butter out of petroleum and honey out of shingles, with by-products which smell like a cow's breath and blow up with forty thousand horse-power; identifying the rheumatism microbe and subcutaneously injecting heart juice for heart failure; poisoning marine worms, propelling bicycles by electricity and making submarine torpedoes out of paper; making folks wash themselves; proving by mathematic demonstration that the vortex atom is the one thing in the universe that really does exist, when along comes Edison, saying the atom knows good and evil, just like folks.

Raising ghosts and ghostesses, inventing chess problems for gain, and getting real money for treatises on grammar, on the immortality of the soul, on the moral purpose of Shakespeare's plays and of Walt Whitman's style, and diagnoses of Byron's club foot and Richard III.'s abnormal spine.

These are some few, and very few, of the ways by which that stirring half of the world, which is neither very poor nor thoughtful, actually lives. Is it to be doubted that the fragment which titters to confess it doesn't know how the poor half does live, commonly knows even less about how this ingenious half is living and what it is living for?—*N. Y. Sun.*

DEPOSITS of tin, very promising in value, have been found on the eastern slope of Laguna Mountain, near San Diego, Cal.

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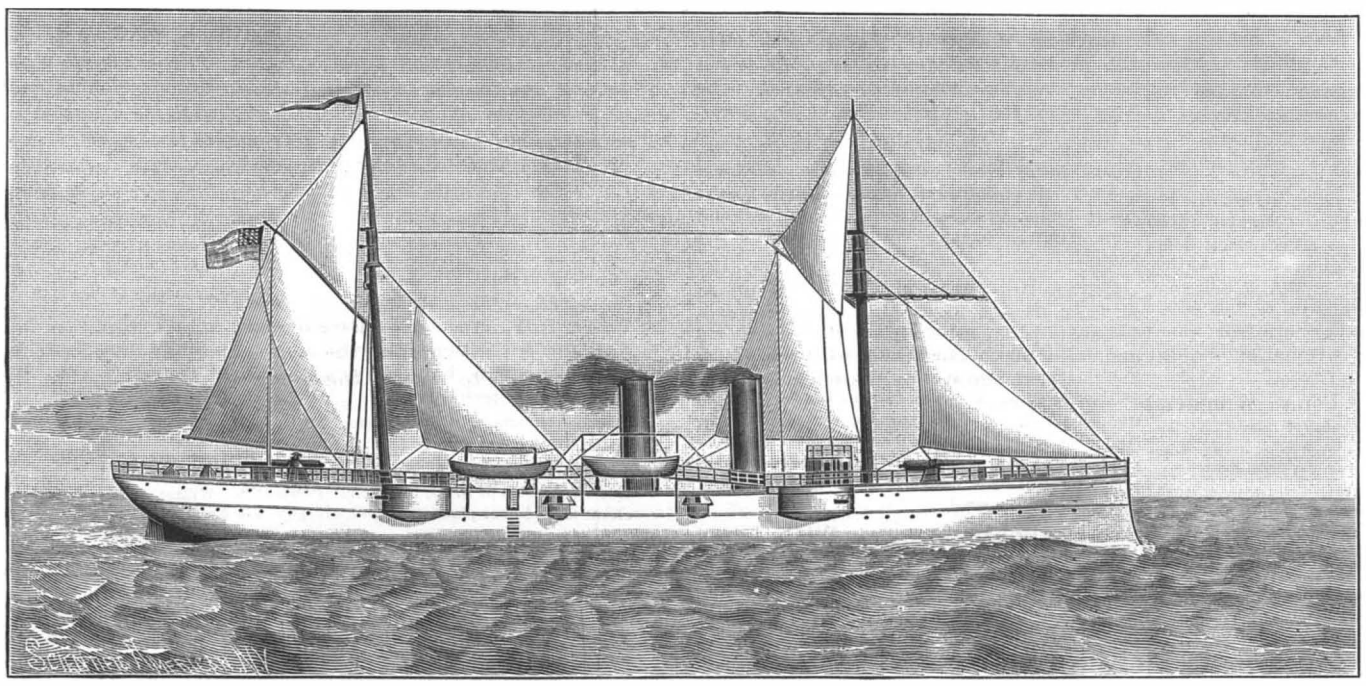
ANOTHER UNITED STATES CRUISER AFLOAT.

The first one of three 2,000 ton steel cruisers authorized by Congress in 1889 was launched at Baltimore October 28, from the ways of the Columbian Iron Works and Dry Dock Company. She had been previously known as No. 10, but was christened the Detroit, being classified as second rate, the law requiring such vessels to receive the names of cities, although the people of Baltimore had desired to have her named North Point, in honor of the battle fought there in 1814. Of the other two vessels authorized by Congress at the same time, one is being built at the Columbian Iron Works and the other at Boston. The launch was witnessed by a great crowd, and was in every way a success. Among others present were: Commander Willard H. Brownson, who will command her when she goes into commission; Commander Charles H. Davis, Chief Engineers George W. Roche and J. A. B. Smith, Assistant Engineers C. A. E. King and D. W. Redgraves, Naval Constructor Joseph J. Woodward, Mr. Powell, chief draughtsman of the Bureau of Construction, Navy Department, and Ensign William R. Shoemaker.

The Detroit's keel was laid March 16, 1890, and her cost is to be $612,500, exclusive of armament. She is 257 feet long on the load water line, has an extreme breadth of 37 feet, with a mean normal draught of 14½ feet. Her engines are designed to give her a speed of 18 knots. She is almost identical in displacement with the two Chilean cruisers recently built in France. Congress limited the cost of each of these three vessels to $700,000 for a guaranteed speed of 17 knots. An allowance of $100,000 will be made on each vessel should 18 knots be made. The Detroit has what is termed an open gun deck, the poop and forecastle decks being connected by a bridge extending fore and aft. There is extended through the principal part of the vessel a center-line vertical bulkhead, which not only helps to support the water-tight deck, but adds "backbone" to the vessel.

Especially interesting is the coffer-dam protection along the entire machinery space, which is to be filled with cellulose. Cellulose is manufactured from the fibers of cocoanut husks and has the property of absorbing eight times its weight of water. The French government proved by tests that ships built with a lining of cellulose would be practically unsinkable. There will be 500 cubic feet of cellulose in the coffer dams in the Detroit.



THE NEW STEEL CRUISER DETROIT—2,000 TONS.

Naming the Vessels of the New Navy.

The present law requires ships of the first rate to be named after States and those of the second rate after cities, but there is an existing confusion both as to rating and naming which Congress, sooner or later, no doubt, will modify. We now have State sponsors for the three big battle ships of 10,200 tons each, the Indiana, Massachusetts, and Oregon; for the armored cruiser of 6,648 tons building at Brooklyn we have Maine; for the battle ship of 6,300 tons building at Norfolk we have Texas; for the armored cruiser of 8,150 tons we have New York. To these it is believed will be added California, as the name of the 5,500 ton protected cruiser now known as No. 6, under construction at the Union Iron Works, San Francisco. It is thought that the name Pennsylvania may be given to the triple screw cruiser, No. 12, of 7,400 tons, now building at Philadelphia. She is already nicknamed Pirate, but the statutes do not allow her to carry that as her permanent appellation, and with her rating she must have the name of some State. Her sister ship, No. 13, would, of course, follow the same rule, or otherwise she might be styled the Corsair. The new rules are expected to make all vessels displacing 5,000 tons or more first rates. On this point the Senate and the House agreed in the last Congress; and, furthermore, they agreed that all between 5,000 and 3,000 tons should be second rates. They differed on the method of naming, and the modification of the statute as a whole was postponed. But it is clear why the 5,500 ton cruiser will take the name of a State, and why, on the other hand, the Chicago of 4,500 tons, the Baltimore of 4,400 tons, and the Monterey of 4,048 tons, have received the names of cities. We have now nine new vessels, ranging from 5,500 tons to 10,200 tons, named or hereafter to be named after States, representing all parts of the Union.

In the next class or rate we have already named after cities the Atlanta and the Boston of 3,000 tons each, the Raleigh and the Cincinnati of 3,183 tons each, the Charleston of 3,730 tons, the Newark and San Francisco of 4,083 tons each, the Philadelphia of 4,324 tons, the Baltimore of 4,400 tons, and the Chicago of 4,500 tons. To these we now find added the Detroit and probably the Mobile of 2,000 tons each, while the third 2,000 ton cruiser building at Boston will also have the name of a city.

The theory of the new rating, not yet authorized by law, makes third rates include everything between 3,000 and 1,000 tons. To such vessels of the new navy could be applied, as in the case of the three 1,703 ton gunboats, Yorktown, Bennington, and Concord, the names of battles in our history. Examples of vessels in the old navy carrying the names of cities are the Lancaster, 3,250 tons; the Pensacola, 3,000; and the Hartford, 2,900. The Omaha, 2,400, will probably see no more active service.

Turning to the smaller vessels of the navy, the existing rules in regard to the President's discretion have produced names no two of which are of the same character, but all appropriate. Thus we have the Dolphin and the Petrel, excellent names for the 1,500 and 885 ton gunboats, each of which is the only one of its type. We have the Vesuvius, a good name for a pneumatic guncotton vessel, although hitherto it has not been a Vesuvius in eruption. The torpedo boat Cushing has been very aptly named from the gallant destroyer of the Albemarle, while doubtless torpedo boat No. 2, now building at Dubuque, will be as fitly christened. For the Naval Academy practice vessel the name Bancroft has been suggested, and very appropriately, in view of the great work done by Secretary George Bancroft toward founding the Naval Academy. Finally, names are yet to be selected for the two 1,000 ton gunboats building at Bath.

Printers' Profits.

Mr. Theodore L. De Vinne, in an address to the National Editorial Association, made the following remarks:

. . . The cost of presses is a serious expense, but if they can be kept fairly employed there need be no loss. As a rule, presswork is the profitable branch of the business. It is the composition room that is the great sinkhole. It is in types and wages of compositors that the profits of the house are lost.

. . . When an office is small and can afford to buy but one or two presses, they should be of the best. A printing machine which can print a newspaper only and which cannot print a book form; that will print a poster and will not register for colors; that will print an ordinary pamphlet and that has not strength enough nor inking rollers enough to print wood-cuts—that machine is an expensive press, even if it does cost $1,000 or $2,000 less than a perfect machine. I know from experience that it takes a long time to earn $1,000 on one machine, but I know also that one can lose the chance of earning that $1,000 in delays and bad work in attempts to get on with a poor machine. A machine that can do any kind of work from a poster to a wood cut is always a cheap machine.

Good machines call for good men. It is a mistake to allow a machine which costs thousands of dollars to be managed by an incompetent pressman. The incompetent man always does from three to ten tokens less a day, always uses more rollers, always wastes more paper and ink. The superior performance of the qualified workman fairly justifies his higher wages. The damage that the machine receives from men who do not know how to handle it is great. Men who cannot keep their presses clean and who are viciously meddling with impression screws, bearers, and rollers, are dear at any price. Upon the pressman, more than any other workman, depends the credit of your office. Clean presswork hides a multitude of sins of composition. A good pressman can protract the life of your type one-half longer than the poor one.

Curious Foundations.

The *Railway Review* tells of a novel method of laying foundations in swampy soil recently employed by an American engineer. The building to be supported was a low wooden one which it was proposed to use for the storage of machinery. Casks were set in holes in the ground along the line of posts and were filled to the depth of about one foot with iron turnings. The posts were placed in the casks, which were then filled with iron turnings compactly rammed in place. A solution of salt and water was slowly poured over the turnings, under the action of which they solidified into a hard mass. The heat of the oxidation of the iron was so great that the posts were charred. This also served to act as a preservative, and to that extent the iron turnings are probably superior to concrete under similar conditions.

Precautions against Fire and Rats.

In a communication to the New York *Evening Post*, Mr. A. W. Page makes the following excellent suggestions: One could not contrive a more perfect system of arranging a quantity of lumber to have it burn quickly than by using it to construct a modern house. The open spaces in the outside walls between the boarding and plastering, and in the partitions and between the floor timbers, form a perfect network of flues. If a fire starts in the lowest part of the house, those flues, with the shavings and chips usually left there, carry the fire to the attic and roof instantly; or if it starts above, the coals and fragments of fire fall down through those flues, thus spreading the fire very rapidly.

The suggestions that I have to offer as an improvement are, let the lining floors in each story extend to the outside boardings, and lay one course of brick in mortar on the floor between the studding; refuse or broken brick or small stones will answer; fill in inside the partitions in the same way if necessary, not forgetting to stop at all openings around steam and other pipes and every other place where a mouse would be liable to go or gnaw through. A little care and eight to twelve dollars will cover the cost in an ordinary house. At greater expense more might be done as a protection against fire. If the house is plastered before the finish is put on, it is a good plan to plaster down to the lining floor on the outside walls, and, in fact, all of the walls, instead of plastering to grounds six or seven inches from the floor.

A Medal Worth Having.

The gold medal which was presented to Professor Virchow, of Berlin, on the occasion of his seventieth birthday, recently, weighed nearly six pounds, and represented a value of about 350*l.* in pure gold. Mme. Virchow received a silver, and each of the Professor's children a bronze replica of the medal. The obverse shows the bust of the Professor, with the legend: "RVDOLPHVS VIRCHOW. POMMERANVS CIVIS BEROLINENSIS: AETAT LXX." On the reverse is an allegorical group representing the genius of investigation, winged, and carrying a flaming torch in the left hand, while with the right he lifts the veil of Isis. At the foot of the Isis column is a table with the representation of the Berlin Pathological Institute. In the background Science, on her lap an open volume, is seen contemplating a skull, while around her are other pathological emblems. The inscription on this side is "Omnis cellula a cellula."

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — Henry W. Hoss, Gamma, Mo. This device is automatic in coupling, and does not require the brakeman to step between the cars in coupling or uncoupling, while it is designed to be very simple and durable in construction. Spring-pressed plates are mounted to slide opposite each other in the drawhead, and a coupling link having an arrow-shaped head on each end is adapted to pass between the plates to press them apart and finally engage with the back of the head the inner ends of the plates, which are pressed toward each other by the springs.

CAR COUPLING. — Patrick Lee, Boise City, Idaho. This device is adapted for use with cars of the same or different heights, and is arranged for coupling from either side or the top of the cars, without the need of the trainmen going between the cars. The invention consists of a link pivoted at one end in the drawhead and a pin fitted to slide in the drawhead and adapted to be pressed on by the opposite drawhead of the car to be coupled, the pin being adapted to engage the link to swing it into position to couple the other drawhead. The construction is simple and durable, and a car provided with the improvement may be readily coupled with one having the ordinary link and pin coupling.

Engineering.

LINK MOTION. — John Lunz, Claflin, Kansas. This invention relates to valve gear mechanism for engines, providing a valve motion designed to relieve the reverse rod from all strain while the engine is at work, and throw the entire motion direct on the valve pin. The outer ends of the eccentric rods have hooked members, which are pivotally joined to the upper and lower end of a slotted reversing frame, the slots being of greater width at their ends but contracted at the middle to a width just enough to accommodate the valve pin. The motion is direct through the respective rods on the valve pin, and the plates of the reversing frame have a free movement without frictional contact with the valve pin.

Mechanical Appliances.

AXLE ROLLING MACHINE.—James S. Patten, Baltimore, Md. This invention provides a machine of simple construction designed to roll both the spindle or arm and the body portion of the axle section. Within a suitable framing is a pair of main rolls having around their circumference grooves or cavities adapted to form the body of the axle, while end rolls with grooves or cavities are adapted to form the axle spindle, the grooves being formed to open out at the end of the end rolls. The number of rolls may be increased at will and the form of the cavities varied to roll any desired form of spindle or axle body, while a simple, easily operated and effective feed for the axles is provided.

YARN NIPPERS. — Louis Wimmer, Elizabethport, N. J. This invention relates to the nippers or nipper heads of yarn or twine spinning machines, and consists in a nipper die provided with a movable wear block having several wear faces that may be successively brought into the path of the sliver to receive wear as the preceding one becomes worn. With this construction, when one surface will no longer exert the proper tension on the sliver, the wear block is merely given a slight turn to bring the next succeeding wear surface in line with the passage through the head.

SPINNING MACHINE YARN NIPPER.—This is another invention of the same inventor for a device from which knots or obstructions of the fiber may be easily removed without dismembering the parts, and which will produce tightly twisted, smoothly finished yarns or twines, of any desired size or gauge, with economy of time and labor. The bed die of the nipper has a groove or channel receiving the yarn and provided with a medial cavity and a transverse opening, while a yielding die has a convexed face, between which and the concavity of the bed die the sliver passes at the transverse opening while being twisted.

MILLSTONE DRESSING MACHINE. — George A. Smith, Cohoke, Va. This machine is designed to quickly cut furrows and facing on stones, and consists in a main frame carrying a socket secured to the drive spindle to turn a stem or spindle carrying a drive gear, while a circumferentially and radially movable cutter frame is arranged to carry a vertically reciprocating cutter or chisel, there being a jointed connection between the cutter frame and the main frame, and belt and gear connections between the cutter-operating devices and the gear on the socket spindle. The cutter-carrying frame is automatically fed radially toward the eye of the stone when the machine is used for cutting furrows.

Mining, Etc.

ORE CONCENTRATOR. — Edward W. Clark, Butte City, Montana. In a suitable framework a central vertical drive shaft carries two circular tables, one above the other, the tables having concentric steps thereon, while a series of water pipes is arranged to deliver upon them. The ground ore or pulp is delivered centrally on the upper table, and as it is washed the heavier portion is left on each step. As the table revolves, the concentrates are rewashed, until removed by outward pointing jets and a scraper, the tailings being washed on the lower tabie.

ORE SAMPLING DEVICE. — Robert C. Hawley, Pueblo, Col. This invention consists of a hopper, and dividing wings arranged under it to divide the ore passing down into halves. The hoppers also may be arranged one above the other, and dividing oscillating wings arranged alternately with the hoppers, so that the wing below a certain hopper divides the ore from that hopper into halves, of which one-half is guided by the wing into the hopper next below. The construction is simple and durable, and the device is designed to give an accurate sample of any quantity of ore passed through it, whether fine or coarse, the sample being cut down to the size desired.

Agricultural.

HAY RAKE.—John H. Soehren, Everly, Iowa. This is a simple and effective implement whereby the hay may be placed in a windrow at the right or left of the implement, or may be carried straight ahead. When it is desired to dump the hay, or free the rake head from engagement with it, this is accomplished by means of a lever within easy reach of the driver, whereby the teeth may be elevated from the ground, the hay being left in such position as greatly to facilitate the work of the loader following the rake.

Miscellaneous.

REFRIGERATOR AND GAS GENERATOR. —Harry B. Cornish, Hampton, Iowa. This is a combination apparatus for the cooling of refrigerators, cars, and cold storage compartments, and which may also be employed to furnish gas to a burner or gasometer for lighting purposes. The refrigeration is effected by the use of gasoline or other volatile fluid, in conjunction with compressed air and an atomizer, the gas generated by the air and fluid forced through the atomizer being sprayed into coils of pipe in the compartment to be cooled, and all the fluid not generated into gas finding its way back to the fluid receptacle.

DIVING SUIT. — Joseph L. Boucher, Emery H. Brault, and Romuald Filteau, West Superior, Wis. This invention provides an armor to be worn under a rubber suit, to give greater air space and prevent the pressure of the water from interfering with the comfort and use of the limbs and body, thus enabling the diver to work at a greatly increased depth. The armor has its body portion made in two hinged halves working about a vertical axis, and has longitudinal articulated limb braces to which are attached circular rings or ribs, the body section having an adjustable slide for increasing or diminishing the size of the arm holes, while the crotch and the body section have an articulated connection with a vertical adjustment.

BOTTLE WASHING MACHINE. — Otto Eick, Philadelphia, Pa. This is a simple and durable machine adapted to simultaneously wash a large number of bottles, which are not handled by the operator. Connected with the water supply are revoluble pipes, each having a cleaning device at its discharge end, the nozzles passing through a sliding frame on top of which is held a crate supporting the bottles so that the nozzles pass into them. Each set of bottles may be subjected to one or several scrapings by the movement of the frame.

CIGAR BUNCHING MACHINE.—Thomas and Lee B. Hancock, Richmond, Va. This machine is designed to quickly and evenly wrap the binder around the tobacco fillings, the binder being wrapped as smoothly at the point as at the butt end of the bunch. The rolling apron is constructed, in connection with traveler slides, to act as formers, so that after the binder has been placed upon the fillings the cigar body will have its proper shape ready for the outside wrapper. The machine is designed to be made at a small cost and easily operated.

CHECK BOOK.—George L. Winn, Jersey City, N. J. In this book the checks are printed consecutively on the same side of a single sheet, which is so folded that only a portion of the checks or the entire number may be rendered quickly visible, the checks being removed singly or connected in sheet form. The stubs are also continuously connected, and having a continuous column for records, thus dispensing with the carrying over of balances from page to page, and enabling one to readily detect and rectify mistakes.

MAIL WAGON.—Robert R. Richardson, Portland, Oregon. The body of this wagon has a fixed vertical flange extending around its sides and front, and a revoluble turret is mounted on the body within the flange and provided with a series of compartments. The turret is held in fixed position by a ratchet mechanism, and may be revolved by means of a lever. It has compartments having openings through the outer walls, and other compartments with pigeon holes and swinging doors, adapted respectively for newspapers and letters, the wagon being designed for carrying assorted mail or distributing light articles, and so constructed that the various compartments may readily be brought within easy reach.

SASH FASTENER. — Joseph De Mars, Albuquerque, New Mexico. This is a device for locking both the upper and lower sashes, and consists of a casing supporting two bolts arranged at right angles to each other, there being independent springs for operating the bolts in one direction, one of the bolts being movable longitudinally, and the other longitudinally and rotarily, while it has a crank-like arm to engage the bearing of the first bolt. The construction is such that the lower sash may be locked closed or at any desired height, and the lower sash may be locked to the upper sash, so that the two sashes may be held in any suitable position or entirely closed.

COOKING APPARATUS. — Paul L. Dermigny, New York City. This is a foldable apparatus designed for tourists, etc., and forming also a convenient storage receptacle for articles previous to cooking. It has a base forming a fuel receptacle, and to which is hinged legs supporting two concave dishes held together at their edges and forming a shallow air tight vessel, the upper dish being adapted for use as a plate or saucer. Suitable keepers are provided for retaining a knife and fork, and a separate dish is provided for alcohol to be used in cooking if desired.

SCISSORS.—William H. Sample, Albany, N. Y. In these scissors a swinging latch is pivoted to one blade and provided with a notch in one side edge to receive a portion of the pivot, which is reduced adjacent to its head. The latch forms a permanent attachment of the scissors, and the invention is an improvement on that class of scissors in which the pivot has a notch engaged by a latch to hold the two blades together.

BUCKLE FASTENER. — Frederick A. Blackburn, Bisbee, Arizona Ter. This fastener is composed of two independent metal parts or slides, one part having a flat, band-like loop, with a projecting flat tongue having a pin on its face, while the other part has an upper or outer flat base piece forming an intermediate band-like loop provided with a pin beneath, small holes being punched in the strap for the pins. By this means the buckle may be fastened to a strap without sewing or riveting, the fastening being very durable.

GATE WORKER.—Silas Portis, Monrovia, Ind. This invention provides an apparatus for opening and closing a gate in a carriage way, as the wagon approaches and leaves the gateway, doing away with the necessity of a gate tender. The gate is connected by rods and chains with a lever pivoted on a post at the side of the roadway, a few yards distant, and this lever is connected with a crank in the path of the vehicle wheel, by means of which, as a vehicle approaches, the lever is operated to swing the gate open, a similar crank and lever connection operating to close the gate when the vehicle passes beyond it.

WIND TOY.—Johann R. Zuberbuhler, Greenville, S. C. This device contemplates the mounting of sail boats or similar bodies on arms pivoted at a common center, there being also retarders upon the arms. The whole forms a toy to be carried in the hand to afford amusement to children, or to be arranged for support as an ornament in a garden or lawn, where it may be employed to keep birds away from small fruit and seed beds, etc.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

DECEMBER NUMBER.—(No. 74.)

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1. Handsome plate in colors of a cottage erected on Great Diamond Island, near Portland, Maine, at a cost of $800 complete. Floor plans and perspective elevation.
2. Plate in colors of a beautiful residence at Chester Hill, Mount Vernon, N. Y., also a second view in perspective, with floor plans, etc. Cost $8,500.
3. A comfortable cottage to cost $3,000. Plans and perspective.
4. Design of an ornamental oriel or bay window from a dwelling at Paris.
5. A colonial house erected on Chester Hill, Mount Vernon, N. Y., at a cost of $8,000 complete. Floor plans and perspective elevation.
6. Dwelling at Montclair, N. J. Cost $3,500 complete. Floor plans and perspective.
7. An attractive cottage at Portchester, N. Y., estimated cost $4,200. Perspective and plans.
8. Handsome residence at Bensonhurst, Long Island, erected at a cost of $7,000 complete. Perspective elevation and floor plans.
9. Sketch of a small cottage or lodge.
10. Block of seven dwellings recently erected at Brookline, Mass., at a cost of $150,000 for the entire block. Messrs. Fehmer & Page, architects, Boston, Mass. Floor plans and perspective.
11. A handsome house for $7,500 erected at Montclair, N. J. The design is a unique model of coziness. Floor plans and perspective.
12. Triumphal arch, Timegad, Algeria, from a drawing by Mr. Alexander Graham, F.S.A.
13. Restoration of triumphal arch, Timegad, Algeria, from a drawing by Mr. Alexander Graham, F. S.A.
14. A modern dwelling of attractive design erected on Grand Avenue, at Asbury Park, N. J. Cost $4,500 complete. Floor plans and perspective elevation.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3682) C. P. M. writes: 1. In query (3494) page 251, you say that if a rifle ball be fired perpendicularly into the air, it will have a greatly lessened penetration on its return, while philosophies say the velocity is the same both ways. Then why would it not have the same penetration downward? A. We think what the "philosophies" say must be modified by the further statement that, to secure such results, the ball must be fired in a perfect vacuum. The air resistance certainly diminishes the height to which the ball rises, and retards its descent, so that its penetration must necessarily be greatly diminished by its excursion in the air. 2. Could the motor described in SUPPLEMENT, No. 641, be run with gravity batteries such as are used in depots? A. Gravity batteries are not adapted for running motors of the size given.

(3683) A. S. Q. says: Suppose a man to fall overboard from a vessel in midocean, water very deep; will he go to the bottom, or after having reached a certain depth, will the water be too dense to allow of his sinking further? A. There is every reason to believe that any body that will sink at all will sink to the bottom. The known fact that fishes live at the bottom of the deep seas, that water is but very slightly compressible, and that organic bodies are also equally or more compressible than water, sustains this view.

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A substantiating fact is known that a wooden whaleboat has been carried down so d ep in the ocean by a harpooned whale that when the whale rose to the surface and was captured, the boat had to be hauled up by the line, and was found to be so thoroughly water-logged and compressed by its few minutes' dive that the wood had become heavier than water. Fishes having live elastic tissue are compressed to the same extent, but recover in rising by their own exertion. It has also been stated that whales that have received a death shot and dived have not come to the surface, although watched for during several days.

(3684) L. N. writes for an effective exterminator for fleas, etc., on domestic animals, and for bed bugs and all other pests of the kind. A. A little of the essence of pennyroyal sprinkled about is said to be effectual in driving away fleas; Persian insect powder is also used for the same purpose, and we doubt if anything is more efficient than fresh Persian powder of good quality for the destruction of bed bugs and other pests of a similar character. Buhach or pyrethrum (see SUPPLEMENT, Nos. 247 and 299) is highly recommended.

(3685) F. M. S. asks: How many times will I have to carbonize my plater and rods, as described in "Experimental Science," for carbons to use in batteries? A. They will answer very well without recarbonization; but two or three repetitions of the process will improve them.

(3686) W. G. R.—We favor the Staten Island stone, which is a fine grained trap rock. It takes a fine finish.

(3687) W. H. L. asks: 1. Will a dental lamp of one-half candle power, requiring from 3 to 4 volts and 1·20 amperes, work successfully from a medical battery composed of two bichromate cells and an induction coil? And whether it should be attached to the primary or secondary wires? A. Two bichromate cells should easily run a one-half candle lamp. The lamp should be run directly from the batteries, the induction coil being disconnected. 2. What is the E. M. F. and amperage of the Roberts storage battery? A. The E. M. F. of all storage batteries with which we are acquainted is about two volts. As we do not know the constants of the battery referred to, we cannot state the amperage. 3. What is the principle of the governor of the speed in motor of Edison's phonograph? A. The governor of the Edison motor used in the phonograph is a centrifugal governor, which operates by shunting the current through resistance. 4. Can a rheostat of 16 candle power lamps be used successfully with current supplied by an Edison 120 volt incandescent circuit, to do electro-plating? If so, how must the lamps be arranged for silver, gold, copper and nickel plating? A. You may put a lamp in series with your bath. This will give you in the neighborhood of one-half ampere of current. The voltage of the bath terminals will depend on its resistance. For more current put more lamps in parallel, and carry one lead joint to one terminal of the bath, and a single lead from the other terminal to the other main wire. 5. What is the best kind of watch demagnetizer to use with my rheostat? What is the principle of it? And how could I make it? I have a commutator or alternator which is turned by a crank. A. A good way to demagnetize a watch is to attach it to a twisted string and twirl it in front of an electro-magnet, at the same time withdrawing it from the magnet as it rapidly revolves. See query 3275.

(3688) H. R. B. asks: What is the composition used in making rollers for printing presses? I have some pieces of copper tubing of the proper size and wish to make some rollers. How shall I proceed? How long should they be left in the moulds? How shall I get them out? A. Printers' rollers are made by soaking good white glue until it swells to a jelly, drain off all excess of water and mix with an equal portion of glycerine, heat with care so as not to scorch and evaporate the water until the proper consistency is obtained for the required work; which must be done by taking out a small portion, say a tablespoonful, and pour into the bottom of a small tin pan and set the pan in cold water to cool it to the proper temperature. This may require several trials. When the mass becomes of the right temper, pour into the mould, which should be very smooth inside and greased; with the spindle set exactly in the center. Let the mould stand for a day to get thoroughly cold and set, when the roll can be slowly pulled or pushed out by the gudgeon.

(3689) Mrs. Dr. B. asks how to remove iron rust from linen. A. If the ground be white, oxalic acid, employed in the form of a concentrated aqueous solution, will effectually remove fresh iron stains.

(3690) H. L. N. writes: The singeing of hair is at present greatly agitated by the professional tonsorial artist, claiming that through this process the hair will become more vigorous and prevent its falling out. This naturally would be a great benefit for persons with exceedingly thin hair, and especially for those who possess the misfortune of getting bald. Please inform me of your opinion on this subject. A. The remedy appears to be worse than the disease.

(3691) F. M. asks what the influence of a powerful current of electricity would be on the felting of furs? A. As fur is a non-conductor, we think a powerful current would have no effect on it. Possibly static electricity might be of some service. An experiment would determine this.

(3692) J. L. L. asks: Is there any cement that will fasten stereotype plates to wood bases? I have some plates difficult to nail, as the cut takes all the space. A. We cannot recommend any cement for the purpose. There are cements that would answer for a short time; but the wood is apt to swell and shrink under use, and this, together with the heavy pressure of the press, would be likely to loosen the plate and do injury to the type forms.

(3693) B. T. writes: I found mica float on the surface of the ground scattered for some distance in detached chunks, 10 by 14 inches in width and from 4 to 10 inch in thickness. The float is not transparent, but cloudy, etc. Does the mica lie in veins or deposits like other minerals? Please state what formation is mica found in. How would a person go about to discover where the float came from? A. No general rule can be given for prospecting for mica. The mineral mica is found in very irregular veins of what is often a coarse granite rock. It occurs in the primitive rocks, such as gneiss and granite. Only general Rules for prospecting can be given. In the Mineral Resources of the United States for 1887, published by the Department of the Interior, Washington, D. C., you will find an interesting and practical article on the subject of mica. We recommend also Anderson's "Prospector's Manual." $1.50 by mail.

(3694) C. H. M. says: 1. When matter of different specific gravity, but free to move independently in the same mass, is rapidly rotated, what will be relative position taken up by the heavier and lighter parts? Example: Suppose a hollow sphere, partially filled with oil and water in about equal parts, to be rapidly rotated on an axis, will the oil hug the equator and the water be in a ring inside of the oil, or the reverse? Or, what is somewhat equivalent, suppose the earth's rotary motion to be accelerated until all the water on the globe should be thrown out in a ring a thousand miles from the equator, would the earth's atmosphere be outside or inside of the water ring? A. Centrifugal force acts inversely as gravity. The heaviest element goes to the outer side in a centrifugal apparatus. The condition and disposition of the material of the earth would not come under this condition, because gravity must be the greater force, or the material would not hold together, but would fly off into space. Hence the heaviest or densest material would still gravitate to the center. 2. What is the explanation of a substance rubbed against itself producing more friction than if rubbed with equal force against a dissimilar substance? For illustration, two pieces of iron, or of wood, of the same kind, rubbed against each other with a force equal to x, will encounter more friction than if a section of the iron is rubbed with the x force against a piece of the wood. Is there a standard of equivalency established in respect to friction of different substances, bearing against each other in motion? A. In regard to friction of soft or hard substances, so much depends upon lubricants and the smooth and even surfaces that are moving over each other that no general explanation or theory will suit each case. Otherwise, the fact is apparent that soft substances moving upon each other with pressure do not adjust their surfaces of contact to a perfect plane, and are frictionally retarded according to its minute inequalities; whereas, with surfaces of unequal hardness, the tendency of the hardest surface is to assume a perfectly true surface by wear which is found to have the least friction. 3. What is the pitch of ordinary heavy rumbling thunder? How long would a closed organ pipe have to be to produce sound of the pitch of heavy thunder? A. The pitch of ordinary rolling thunder varies considerably, ranging through the median notes of the base clef, and would require a pipe from 8 to 12 feet long. 4. As forces act most readily in the direction of least resistance, does a sound (on account of the atmosphere diminishing in density as we go upward) act more effectively upward than horizontally? A. Sound vibrates more intensely upward than along the surface of the earth. This has been noticed by aeronauts, who hear ordinary sounds from the earth at great heights.

(3695) H. E. F. says: 1. A Corliss engine has just been erected which has a shaft fifteen inches in diameter and eighteen feet in length between bearings. The shaft and wheel weigh ninety-six tons, the former deflects ⅛ of an inch in the middle from excessive weight. With the wheel in motion will this condition change and the shaft resume a straight line? A. The shaft will not assume a straight line, nor approach near to it, unless the speed is so great that a half revolution is equal in time to the natural vibration of the shaft. As the speed of such engines is far below the requirement for synchronal action with the shaft vibration, you will not be able to discover an appreciable amount of relief from the spring of the shaft by its velocity. The shaft is too small. Would like to have more details of the engine. 2. I am running a compound condensing engine which requires four hundred gallons of water per minute. Could that water be passed through a motor or small wheel as it flows into the vacuum and produce a small amount of power? The source of supply is on a level with condenser. Vacuum 27-28 inches. A. A small motor could be run in the condenser water pipe, but it would be of doubtful utility. 3. We could utilize all of the exhaust steam from the engine above referred to in heating water for dyeing purposes. Under these conditions would it pay to run compound non-condensing? Or would it be better economy to use a surface condenser? Water from jet condenser not available for this purpose on account of oil. A. There would be just as much objection to the use of the exhaust for heating the dye tubs as there is to the use of the injection water. You would still have all of the oil in the tubs. 4. At eighty pounds pressure what should be the number of pounds of steam (in weight) consumed in heating sixty cubic feet of water from 50° to 212° Fah.? Also from 150° to 212°? A. It will require 525 pounds of steam to heat the water as stated from 50° to 212° and 207 pounds of steam to heat the amount from 150° to 212°.

(3696) S. R. T. says: Suppose a lead pipe 2 inches in diameter, laid from a spring, descends 19 feet into a ravine, then up 32 feet to the top of a ridge, thence down 70 feet to the base of a building three stories high. Can this pipe be made to siphon the water and raise it to the top of the building, 32 feet high? If so, what is the best way to fill the siphon. By a pump at the spring or an air pump at the house? What is the limit of useful employment of siphons this way? What is a good practical work on this class of subjects, and do you furnish it, and the price? I should have mentioned that the pipe will be a half mile long. A. The pipe can be made to siphon the water to the house, and should flow about 18 gallons per minute at top of house, if free from air. Place the air pump at the house for convenience. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 793, on siphons. The principle of siphonage is perfectly practicable wherever desirable within the limit of atmospheric pressure as applicable to pump suction, say 25 feet lift, and any height required in an invert siphon. In this way the siphon has been largely used in the United States for water supply. There are no books on this subject.

(3697) G. D. says: In running an inch pipe about 500 feet from a well upon a hill to supply a house and barn with water, to reach house under about 30 feet water pressure, and to be used for culinary and all house purposes, which kind of pipe is best—lead, ordinary wrought iron gas pipe, or the latter galvanized or tarred? Is the tar coating of the pipe durable? It would seem to avoid the rust of iron pipe, and the possible deleterious effects of the zinc salts from galvanized iron. Would the brass of ordinary globe valves cause salts to be formed, either from the brass or from other metals in contact with it, that would be injurious to health? A. Lead and galvanized iron pipe are the best for conveying water for household purposes. Both are perfectly safe if the water is kept running, or the contents of the pipe entirely drawn off after standing in the pipe overnight. The tarred pipe flavors the water for some time and the tar is not durable upon the inside of the pipe. Brass valves do not affect the water to any perceptible extent. The most approved management for a house and barn supply is to keep a small stream constantly running into a watering trough at the barn, with an overflow to an underground drain.

(3698) M. O. R. says: I am building nearly two miles of fence. Oak pickets ½×2 inches 4 feet long, woven in five pairs of wire, Washburn & Moen galvanizing process, in which the zinc is fairly soaked through the iron. Having some doubts as to durability of the oak pickets, I wish to apply some preservative which will not injure the wire, but preserve the wood. Would the Bordeaux mixture (sulphate of copper in a whitewash of lime) do? Is the copper salt injurious, or the lime, or both? Will you suggest something superior? A. There is no objection to the Bordeaux wash. Another way is to use 2 pounds sulphate of zinc and 1 pound salt to 30 pounds dry lime, and color if desired with yellow ocher, or any cheap mineral paint. To give the above a strong body a half pound of glue may be added, dissolved separately. You may also add a little glue to the Bordeaux mixture to advantage. If appearance is no object, coal tar is the best preservative. The whitewashes are not injurious to wood or wire.

(3699) M. C. S. asks: Will it be safe for one who has not had any experience to undertake to make a boiler to run a 2 horse power high pressure engine? What will be the easiest and safest type of a boiler to make? Have you issued any paper, explaining how to construct a small furnace that will be sufficient to melt iron? A. Many amateurs make small boilers and very good ones, but they require some shop privileges. If there is a good pipe fitter in your city, you may with his help make a safe and good boiler for any pressure up 100 pounds or more. You will find illustrations to scale and description of pipe boilers of one to three horse power in SCIENTIFIC AMERICAN SUPPLEMENT, No. 702; you will find a portable furnace for melting 100 to 140 pounds of metal in SCIENTIFIC AMERICAN SUPPLEMENT, No. 180; and for a regular cupola consult West's "Foundry Practice," $2.50 mailed.

(3700) E. S. asks: What acid or solution can I use to rot or destroy stumps in ground after trees are cut down, mostly oak? How long will it take to rot them? A. There is no quick way of rotting stumps. The cheapest way to get rid of them, if you have no suitable means of pulling, is to bore a 1¼ inch auger hole down the center of the stump about 18 inches deep, and put in 1¼ ounces of saltpeter, fill the hole with water and plug it tight. In the spring take out the plug, pour into the hole a half pint of crude petroleum oil, and set it on fire. The stump will burn and and smoulder to the ends of the roots, leaving nothing but ashes.

(3701) H. W. W. says: How can the phylloxera be destroyed? A. Numberless remedies have been suggested and tried—sulphur, carbon bisulphide, coal tar, lime, soap, caustic soda and many others. The following are among the best receipts: See the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 167, 205, 464, 471, 478. 1. Try sulpho-carbonate of potassium and sand. 2. London purple, a by-product in the manufacture of rosaniline, mixed with water. 3. Forty-five pounds sodium phosphate, 15 pounds ammonium phosphate, 60 pounds ammonium chloride, 45 pounds potassium sulphate, 75 pounds of soda, 2,800 pounds iron sulphate, 90 pounds flowers of sulphur. Mix with the soil. 4. Mix 45 parts nitrobenzol, 75 parts sulphuric acid, 1,400 parts water. To kill the eggs, make a paste of 4 ounces benzol, 8 pounds lime, and 360 pounds of earth.

(3702) R. J. F.—Window polishing paste is made of 99 parts prepared chalk and five parts each of white bole and Armenian bole, rubbed together into a smooth paste with 50 parts water and 25 parts alcohol. The paste is to be rubbed on the window, allowed to dry, and then rubbed off with cloths.

(3703) H. T. R. asks how to lag pulleys with paper. A. Scratch the face of the pulley with a rough file thoroughly, so that there are no bright or smooth places. Then swab the surface with a solution of nitric acid, 1 part; water, 4 parts; for fifteen minutes; then wash with boiling hot water. Having prepared a pot of the best tough glue that you can get, stir into the glue a half ounce of a strong solution tannic acid, oak bark, or gall nuts, as convenient to obtain, to a quart of thick glue, stir quickly while hot and apply to the paper or pulley as convenient, and draw the paper as tightly as possible to the pulley, overlapping as many folds as may be required. By a little management and moistening of the paper, it will bind very hard on the pulley when dry, and will not come off or get loose until it is worn out. Use strong hardware wrapping paper.

(3704) L. K. asks: What is the best way to prepare the canvas covering on a canoe to be used along the Florida coast? A. For a canvas canoe, rubber cement or varnish is the safest and easiest to apply. Use the kind obtained through the rubber trade and thin it with naphtha. After a painted coat of the thin rubber has dried, the thick paste rubber may be applied all over the outside with a spatula, and if carefully done will make a smooth waterproof boat. Paraffin wax melted in with a hot iron is excellent.

(3705) G. D. asks how to make a thick rubber cement. A. Rubber cement is made by dissolving masticated rubber in benzole or solvent naphtha. We refer you to "Rubber Hand Stamps and the Manipulation of Rubber." $1.00 by mail.

TO INVENTORS.

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AND EACH BEARING THAT DATE.

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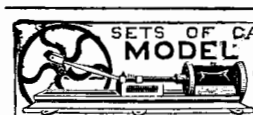

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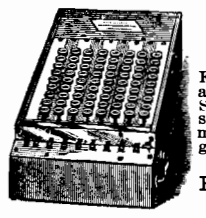

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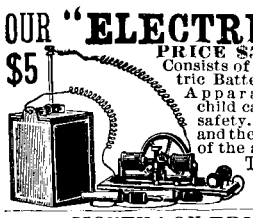

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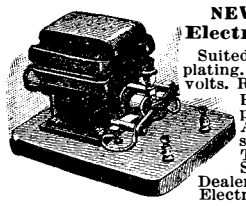

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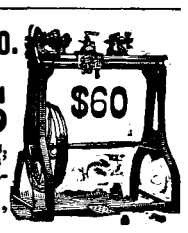

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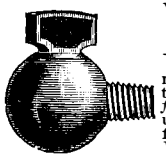

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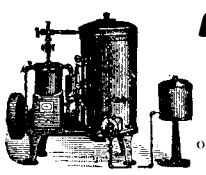

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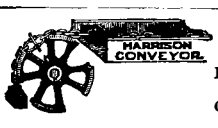

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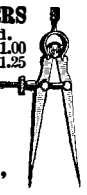

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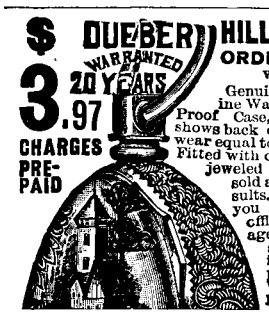

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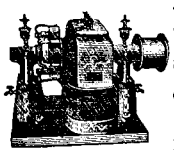

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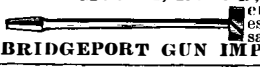

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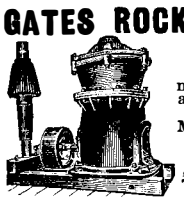

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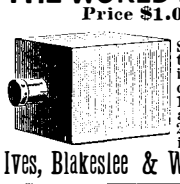

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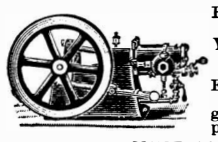

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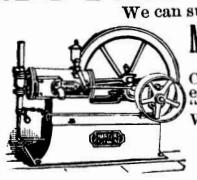

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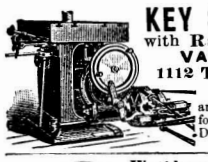

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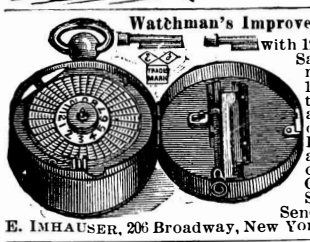

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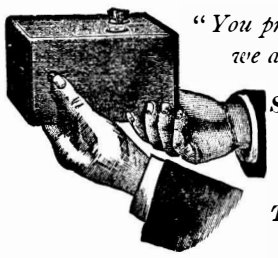

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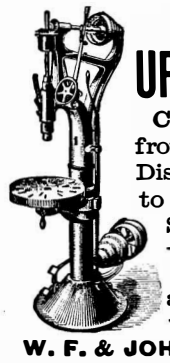

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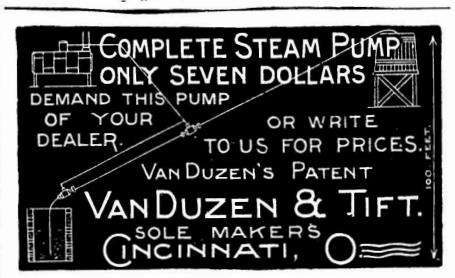

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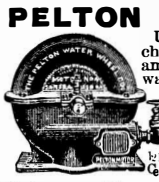

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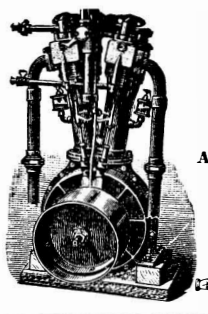

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